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QUALITY CONTROL REPORT
1980

WATER QUALITY SECTION
LABORATORY SERVICES BRANCH

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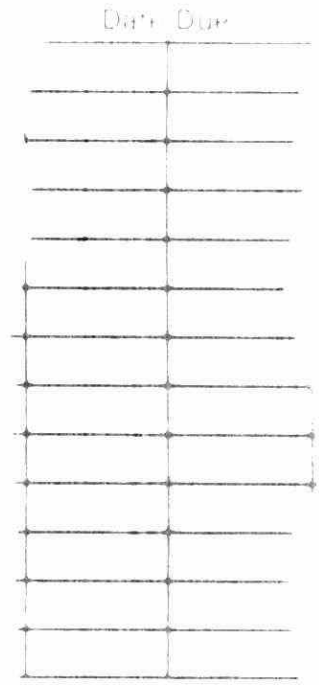
Ontario
Ministry of the Environment

The Honourable
Keith C. Norton, Q.C.,
Minister

Gérard J. M. Raymond
Deputy Minister



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MINISTRY OF THE ENVIRONMENT
JUN 03 1982
HAZARDOUS CONTAMINANTS
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QUALITY CONTROL REPORT - 1980

WATER QUALITY SECTION

LABORATORY SERVICES BRANCH

QUALITY CONTROL PHILOSOPHY

Quality Control requires an acceptance by various levels of the laboratory organization of the concepts of doubt and self appraisal. When these concepts are an integral part of a quality control program, then various levels of the organization are required to actively review their procedures in a regular and organized fashion.

The philosophy of the Water Quality Section requires that the following steps be followed. The technician performs an immediate online appraisal of an analytical operation by comparing the results for daily control samples against historical data. These results are reviewed regularly by the unit leaders and semi-annual overview is conducted by the scientists in charge of the different units.

Furthermore, every new program requires an assessment of the methodologies, sampling trains and instrumentation on hand. These are all well documented.

By following this philosophy we have been able to continuously monitor our operation, make timely changes and maintain a high standard of quality.

This quality control performance report is similar in format to those issued in 1975[1] and 1979[2], however, performance reports are given for each test in each unit rather than grouping all similar tests into one report. This was done to allow the inclusion of more statistical data. Evaluations were based on a minimum of three months data in 1980.

The laboratories listed in this report, and the people to contact for more information are as follows:

PR - Precipitation	- Frank Tomassini - Jenifer McBride
DW - Domestic Water	- Stuart Barnes
SIW - Sewage and Industrial Waste	- Joan Crowther
RL - Rivers and Lakes	- Mike Rawlings - W.B. Moody
Radiotracer	- Paul Roberts

Each report includes an identification section which lists the test name, laboratory, reporting units, and the period for which the data is valid; the Sample Type which lists the general classes of samples for which the procedure was operated; the Sample Preparation which lists any steps required to convert the sample into a form suitable for analysis; the Analytical Procedure used to analyze the sample; the Instrumentation required; and the Calibration settings which include the concentration range, operating scale resolution and the number of standards used to calibrate the test. The Quality Control Data section gives a statistical review of the QC standards and long-term blanks as well as control limits for the test. The Recovery Data section gives a statistical review of any recovery standards and digested or other blanks used in the test. The Duplicate Data section gives a statistical review of non-adjacent within-run duplicates and lists the detection criteria and the relative standard deviation. Definitions and explanations of statistical terms (copied from the 1976[1] and 1979[2] reports) are included in the introduction.

Acknowledgements:

The author would like to thank all the people in the laboratory for their help and advice. Special acknowledgements should be made to Mrs. Joan Crowther, Mr. Walter Wright, Mrs. Fran Hall and Mr. Donald King.

W. B. Moody
Water Quality Section
August 1980.

INTRODUCTION

The major objective of a quality control program for chemical analyses is to ensure immediate detection of any deterioration in instrumentation, chemicals, technique or calibration.

A quality control program for chemicals should involve the purchase of high quality materials, analysis of these chemicals for contamination, and an understanding of the shelf lives and stability in solution of these chemicals. Containers, filters and any other equipment used during an analysis must be checked for contamination, leaching and adsorption effects.

Any instrument used in an analysis must be tested to ensure that it is working properly. For example, zero and full scale readings should be properly adjusted, the instrument should not pick up any stray signals or show any sudden shifts. The instrument should be kept clean and in proper working order and should be allowed to warm up sufficiently before use.

In choosing a technique for analysis one must consider staffing, the availability of equipment and space, the expected work load, the urgency of reporting the result, the quality of the result, and the types of sample to be analyzed. A decision must be made whether to route different sample types to different instruments. Since most natural water and precipitation samples have low concentrations, the analytical instrumentation may have to be designed for optimum sensitivity. Analyzing an industrial waste sample under these conditions may lead to contamination of the equipment. On the other hand, for highly perishable parameters, ranges and instrumentation must be selected which will analyze the samples quickly and minimize off scale readings and the need for repeats. The decision made will affect the sensitivity of the test and the detection capability. In this case, a fast reliable result on a fresh sample may be of more value to the data user than a slow but highly precise result on a decomposed sample.

While a quality control program should encompass all of the facets listed above the greatest effort is probably expended on calibrating the system and checking the calibration.

CALIBRATION

Instrumental sensitivity is set by means of standardized solutions covering the range of instrument response and is performed before the analytical run commences. Since a high degree of precision is required to detect and minimize any between-run changes, these standards are analyzed with as little handling or preparation as possible. For example, TKN standards are made up in a "wash water" solution which closely resembles the pH and composition of the samples after they are digested. The calibration standards themselves are not digested. (Refer to recovery checks below.)

The calibration is confirmed by means of two control standards QC-A and QC-B which are made up and maintained independently of the calibration standards. The system is not calibrated with these control standards. If the QC-A and QC-B values meet the required specifications then the instrument is assumed to be calibrated properly.

The theoretical relationship between concentration, and instrument response, R, can often be shown to be

$$C_S = C - C_O = a_0 + a_1 R$$

where C_S = concentration in the sample after blank correction.

C = measured concentration including reagent blank etc.

C_o = concentration present in a presumed blank.

a_0 = baseline or background instrumental response

a_1 = factor relating a change in concentration to a corresponding change in response.

At levels of analysis close to C_o, the most significant source of systematic error in C_s is in estimating the blank value C_o. At these levels the error is independent of concentration. At higher levels, the most significant source of systematic error is in the measurement of the slope.

Analyzing two QC standards in the upper range of the test would control slope bias only and analyzing two standards in the lower range would control blank bias only. In order to control both the blank and slope biases, QC-A and QC-B are chosen to be about 70% and 10% of full scale respectively.

When the QC-A and QC-B control standards are analyzed and read, their sum and difference are calculated and used immediately to determine whether the calibration process is in-control. This involves the concepts of Warning, Control and Acceptance Limits as defined by variation in the difference (D) between QC-A and QC-B standards. This is estimated by the standard deviation of the differences (S_D) from previous data and is a measure of within-run variation.

Warning Limit: If the current value of QCA - QCB differs from the defined value by more than 2 S_D, then recent past values should be reviewed to determine if a trend towards out-of-control is developing. Analysis may proceed if this is not apparent.

Control Limit: If the current value of QCA - QCB differs from the defined value by more than 3 S_D, then to-day's calibration slope is out-of-control. The analytical run must be stopped and recalibrated.

Acceptance Limit: Systematic error in estimating slope and blank corrections will cause the sum (T) of QCA and QCB to vary excesively. Over the long term if we wish to control between-run standard deviation then the standard deviation (S_T) of QCA + QCB should not exceed S_D by a factor of more than 1.5. Therefore if QCA + QCB exceeds the Acceptance Limit of 4.5 S_D the presence of excessive systematic error is suspected. The analytical run is stopped and recalibrated.

The actual values of QCA and QCB are examined to see if either is suspect whenever their difference or sum is found to be out-of-control but they are not themselves separately controlled. However, over the long term the standard deviations of QCA and QCB (S_A and S_B respectively) can be used to estimate the actual between-run standard deviation and its dependence on concetration. In many systems the in-run standard deviation is not particularly concentration dependent although the between-run standard deviation may be. While the QCA/QCB process is useful for controlling this effect it is often easier said than done. The concept of the Acceptance Limit recognizes that data users do not always require the ultimate performance implied by the variation of in-run duplicates, and that there is much to be gained in terms of method evaluation by allowing calibration to drift in a controlled fashion.

In practice the Acceptance Limit for Sums and the Control and Warning Limits for Differences may be tightened to achieve a particular benefit but in general they should not be set too much tighter than the system can tolerate, and should never be set looser than long-term performance data suggests can be maintained routinely.

A sequential plot of QC-B vs QC-A (a Youden Plot) is also made. In the absence of systematic error, the lines joining the sequential A, B points will be randomly oriented.

As systematic error increases, these lines will tend to be oriented from the upper right to the lower left quadrants and the distribution will change from a circular distribution to a more elliptical one. There are two circles around this graph. The inner circle is a measure of the within-run standard deviation, S_W, while the outer circle is a measure of the between-run standard deviation, S. The definitions of S and S_W are given below:

$$S_W = \sqrt{\frac{S_D^2}{2}}$$

$$S = \sqrt{\frac{S^2A + S^2B}{2}}$$

where:

S_A = standard deviation of A between runs.

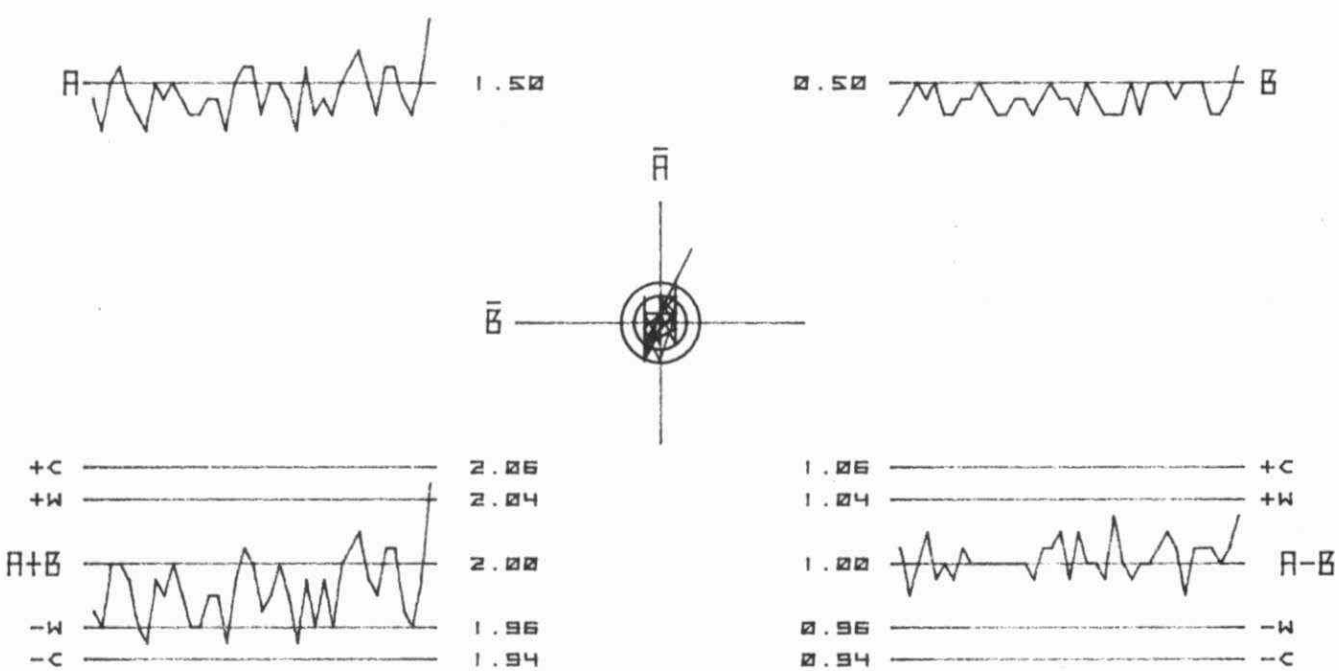
S_B = standard deviation of B between runs.

S_D = standard deviation of D where

D = A - B

The ratio S/S_W permits an assessment of the effectiveness of calibration control. The ratio should be less than 1.5 for between-run effects to be well controlled.

QUALITY CONTROL GRAPHS



The figures above show plots of QC-A, QC-B their sum and their difference. Superimposed on the A+B and A-B plots are the warning and control limits. A Youden plot is also shown.

RECOVERY CHECKS

In methods where sample preparation such as digestion or extraction is required, a recovery check, suitable to that system is required to estimate the efficiency of the analysis. These solutions are not used to calibrate the instrument but corrections for the digestion blank and matrix effects can be estimated and applied if necessary.

Recovery standards are chosen to test all facets of the analysis. If a digestion step is supposed to liberate a substance or convert one substance into another before analysis can take place, then the recovery standard should be chosen to test the efficiency of this step. For example glycine is used to test the efficiency of the digestion step in TKN analyses, and metaphosphate or pyrophosphate is used in the Total Phosphorus test. Without pre-treatment (in this case, digestion) these chemicals might give a zero response in their respective tests. Duplicate standards are prepared at 0%, 20%, 40% and 80% of full scale. These recovery standards are then analyzed in the same manner as regular samples and the results are compared to the untreated calibration standards. The percent recovery can be calculated by:

$$\% \text{ Recovery} = \frac{\text{Measured Value}}{\text{Theoretical Value}} \times 100\%$$

The recovery step should have a 97% efficiency. The recovery bias can also be calculated

Bias = Theoretical value - Measured value

When a number of these recovery standards have been read, a mean and standard deviation are calculated for each.

If on average, the recovery check shows a consistent bias relative to the undigested standards calibration, an appropriate correction factor can be determined and applied.

SENSITIVITY CHECKS

By running in-run standards throughout the run, the analyst can monitor changes in reagents, laboratory temperature, etc. To do this, a blank, a low standard and a high standard are run after every twenty samples and the results are compared to the original calibration standards. Several tests performed on automated equipment suffer from baseline shift throughout the run due to reagents coating out on the glassware.

A gradual increase in peak height of the low and high standards may be due to increasing laboratory temperature while gradual decreases in the peak heights may be due to decreasing temperature or deterioration of the reagents. Sudden shifts in sensitivity should be viewed with suspicion. For example, a sudden increase in sensitivity in the ammonia test may be due to using an ammonia type cleanser in the laboratory.The baseline should not shift more than 5% of full scale over the course of the entire run.

IN-RUN DUPLICATE DATA

Natural samples are selected on a regular basis for nonadjacent within-run duplicate analysis. Generally, one sample out of twenty is run in duplicate up to a maximum of three per day. One sample of each pair is analyzed at the beginning of the run with the QC standards and Recovery standards. The other sample of the pair is analyzed in the regular sample order. By analyzing samples in duplicate, the analyst can estimate the repeatability of the test. Another way of saying this would be to estimate the ability to reproduce analytical results. The observed differences in duplicate results, for all the duplicate samples, are accumulated and sorted according to concentration range. A standard deviation is then calculated for each of these concentration ranges:

s_{ld} = standard deviation low-level with-run duplicates (0 - 20% of routine operating range)

s_{md} = standard deviation mid-level within-run duplicates (20% to 50% of routine operating range)

s_{hd} = standard deviation high-level within-run duplicates (50% to 100% of routine operating range)

The routine operating range is one obtained when the "standard" aliquot of sample is employed. If off-scale readings are observed, the sample is diluted by an appropriate factor, F, and re-analyzed. The observed on-scale reading is then multiplied by the factor F to obtain the answer. The standard deviation of such an answer will be F times the standard deviation of the reading (which should fall at or above mid-scale).

In general, therefore, off-scale answers will have a more or less constant % relative standard deviation as long as the readings were originally above mid scale.

$$\%rsd \simeq 100\, s_{hd}.F/C$$

C = midpoint of range used to calculate s_{hd} until sample inhomogeneity effects begin to have a serious effect on s_{hd}. For such samples it is best to define a more appropriate operating system and range and to develop s_{ld}, s_{md} and s_{hd} data for that system (e.g., rivers vs waste samples vs soils, etc).

Within the specified operating range however, it is usual to expect a relatively more constant absolute standard deviation. Failure to observe such suggests need for better control over operating conditions, or else sample nonhomogeneity may be limiting precision.

If a sample is analyzed a number of times under the same conditions the analyst can expect the results to vary slightly but to fall within a narrow range of values centred about the mean. The within-run precision can be used to estimate the value of the next result on this sample. For a given concentration range:

$$\text{Precision} = 2\sqrt{2}\, S_d$$

where S_d is the with-in standard deviation.

This result implies that the next result will fall within $2\sqrt{2}$ standard deviations of the previous value 95% of the times that it is analyzed. Since the standard deviation may vary from one range to another, the within-run precision will also vary. Therefore when quoting a precision figure, the analyst must also quote the concentration range.

By scattering duplicate samples throughout the run, the analyst can use the results in combination with the in-run sensitivity checks. Widely varying results for duplicates may signal a breakdown in the analytical system. There are a number of reasons why duplicate results may vary widely:

1. Sample inhomogeneity
2. Contamination by glassware
3. Improper reading of the result
4. Improper calculations
5. Improper transcription of the result

If the analyst is convinced that everything was done correctly, he must re-analyze that portion of the run which had the questionable duplicate result. If there is a significant delay in re-analyzing the sample, the analyst must decide which, if any, result to report, especially if the parameter is perishable. Duplicates should be within $2\sqrt{2}\, S_d$ of each other. In practice, duplicates which vary more than 3 S_d are viewed with suspicion.

CRITERIA FOR LOW LEVEL DATA

The analyst can use these standard deviation values from within-run duplicates to estimate the detection criteria and detection limit.

The detection criterion and the detection limit are values obtained by statistical manipulation of data collected from each analytical procedure over an extended period of time. These values do not imply any guarantee on the validity or accuracy of any analytical result, but aid the data user in testing the validity of statements which may be made about a given analytical result or environmental situation.

Detection criterion:

Even when there is none of the target constituent in a sample a non-zero result may be measured. However there is less than a 5% chance that a result greater than 1.64 S_{ld} would be obtained (assuming that bias is controlled and corrected for). Measurements reported below this value should be qualified as below the analytical 'detection criterion'.

Detection limit:

Even when a measured result exceeds the detection criterion it is still not certain that the sample contains more than that amount. In fact the sample concentration could be lower or higher than the measured value by as much as 1.64 S_{ld}. The detection limit, (set at 2 S_{ld}, 3 S_{ld} or 3.28 S_{ld} as desired) reduces the probability that the sample actually contains less than the amount specified by the detection criterion. (These probabilities are 20%, 8% and 5% respectively.)

PRECISION AND ACCURACY

Unfortunately precision does not in itself guarantee that a result is accurate. Different analysts tend to introduce their own bias and this may vary from day to day. The control procedures outlined in this report are intended to minimize the variability in the bias. An estimate of a laboratory's bias can be obtained from intercomparison studies with other laboratories. Successful analysis of pure standards but failure to obtain comparable results for real samples even when all the quality control objectives listed here have been met may indicate that the analytical technique used may be suffering from a lack of specificity for the parameter under study. In other words, the test does not separate the desired species from other species which may react similarly under the test conditions. Before a procedure is put on line, suspected interferrents should be tested and documented, and the test should be compared against at least one other accepted technique. Again, the results of this intercomparison should be clearly documented. Records of method changes and their inherent biases should be kept up to date and must be made available to the data users.

SUMMARY

Quality Control is a system for raising flags to indicate that something unusual or undesirable may have occurred. Corrective action depends on follow-up by the analyst.

Even with all the quality control steps in place, the analytical results will only be as good as the judgement of the analyst performing the analyses. Only he can decide if the calibration is proper, if the recoveries are adequate, if results have to be corrected for changes in within-run sensitivity, if peaks on a recorder are properly formed etc, and if the results appear reasonable. The steps outlined in this report can be used by the analyst to help produce good data, but the ultimate responsibility falls on the judgement of the analyst and the data user.

For the most part, the same criteria were used to assess performance as were used in 1979. As they were well explained in the 1979 [2] report, I have included those criteria again in this report.

Methodology and Calibration Standards

1. Calibration was linear within one percent full scale. When previous experience had shown that the foregoing criteria was attained by a given procedure, fixed point calibrations were accepted, e.g., most titrations and some colorimetric methods. When detection systems were based on conductivity measurements, it was recognized that calibrations would not meet the linearity criteria.

2. For automated colorimetric procedures, the standard cal settings did not bounce up and down.

3. For all colorimetric procedures the full scale absorbance ranged from 0.3 - 0.7.

Blanks

1. Measured blanks: day's water supply, long-term and/or digested blank values were equal to or less than the resolution of the test.

QC-A-B

1. Recovery of both A and B solutions ranged from 98 - 102%.

2. The standard deviations for the determination of A and B were equal to or less than the resolution of the test.

3. The ratio S/S_W was less than 1.5 or the standard deviations for A and B as well as the values S and S_W were equal to or less than the resolution for the test.

4. The sequential plots for A and B analyses did not show a cyclical pattern or long-term drift.

5. The sequential plots for A+B and A-B showed that these values met the control limit criteria; one lapse was tolerated.

Recovery Standards

1. For some procedures there were two recovery standard (R_1, R_2) and a treated blank in addition to the normal A, B and long-term blank; such standards are a check on the overall procedure rather than just the final measurement, e.g., digestion plus colorimetric measurement (R_1, R_2) vs colorimetric measurement only (A, B). For some tests (manual procedures usually), these recovery standards replace A-B, e.g. MBAS. In either case, the data was treated in the same manner as the A-B data, and A-B type criteriae were met within 150% if there is no discussion of the data under "Remarks".

2. For several manual procedures, there was only one recovery standard and a treated blank; the percent recovery fell between 97 and 103% and the corresponding relative standard deviation was less than 5%.

Precision (as estimated by standard deviation for duplicate analyses of routine samples).

1. Precision for low level duplicates (0 - 20%) $\pm \leq$ 1.5x's resolution.

2. Relative standard deviation (100 S_{hd}/mid_{hd} conc) $\leq$ 5%.

3. If a block in the duplicate range chart is missing, it means that insufficient data was available to warrant quoting a standard deviation value.

For systems utilizing chart recorders, resolution is normally equivalent to one line (1%) of the chart paper, but it is one percent of full scale concentration of AAI colorimetric systems. For manually operated spectrophotometers, it is equivalent to 0.001 absorbance units. For titrations it is equivalent to one drop of titrant; the volume for one drop of titrant, however, depends on the instrumentation and can vary from 0.001 mL for the ABU 13 burette to 0.05 mL (50 mL manually operated burette). For gravimetric procedures, it is equivalent to one unit in the last decimal place for the specified balance. If the instrument has a printed scale, it is one division on that scale.

The resolutions listed in the performance reports may also include a factor appropriate to that test.

References:

1. Laboratory Services Branch, Data Quality Report Series, Section 1-A, The Water Quality Laboratories Data Quality Summary, 1975. P. Fellin and D.E. King.

2. Laboratory Services Branch, Data Quality Report Series, Section 1-B, The Water Quality Laboratories Performance Reports, 1975. P. Fellin and D.E. King.

3. Laboratory Services Branch, Detection of Systematic Error in Routine Trace Analysis, 1974. D.E. King.

4. Laboratory Services Branch, Data Quality Report Series, Quality Control Procedures and Objectives, 1976.

5. Performance Report - 1979. Water Quality Section, Toronto, Laboratory Services Branch, January 1980. J. Crowther.

DOMESTIC WATER

LABORATORY

Test Name: ALKALINITY

Lab.: DW

Units: mg/L as $CaCO_3$

Period: from 01/10/80 to 29/12/80

Sample Type: Domestic Waters, Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: After pipeting manually, sample aliquots (50 mL) are titrated automatically with 0.02N sulphuric acid to an endpoint of pH 4.5.

Instrumentation: Fischer Titralyzer II with reference calomel electrode and glass electrode. Buret volume = 50.0 mL; delivery rate and proportioning band are adjusted according to sample type and technician's judgement.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.8 to 1000	-	0.2	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	33	285.0	285.53	0.53	2.931
B	33	57.0	60.11	3.11	1.261
Long Term Blank:	-	-	-	-	-
A+B	33	342.0	345.63	3.63	3.953
A-B	33	228.0	225.42	-2.58	2.177

A+B: calc. WL 4.35 CL 6.53 actual WL 5.20 CL 7.80

A-B: calc. WL 4.35 CL 6.53 actual WL 5.20 CL 7.80

Std. Dev.: within, S_w = 1.539 between, S = 2.256 S/S_w = 1.47

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
$R_1 + R_2$					
$R_1 - R_2$					

$R_1 + R_2$ calc. WL CL actual WL CL

$R_1 - R_2$ calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	31	34	0	65
Std. Dev.:	0.467	1.67	-	1.28
Mean:	96.9	276	-	190
% RSD: -				

Detection Criteria: 0.77

Test Name: CALCIUM

Lab.: DW

Units: mg/L as Ca

Period: from 02/07/80 to 30/12/80

Sample Type: Domestic Waters, Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: After pH adjustment to 12 or more with 1N sodium hydroxide, sample aliquots (50.0 mL) are titrated manually with 0.01M EDTA to the murexide endpoint. The molarity of the EDTA is determined by titrating a standard prepared from calcium carbonate using eriochrome black T as the indicator.

Instrumentation: White, glazed, porcelain sample dishes plus standard laboratory equipment.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.4 to 120	-	0.2	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	101	90.0	89.86	-0.14	0.679
B	99	36.0	36.22	0.22	0.704
Long Term Blank:					
A+B	99	126.0	126.07	0.07	1.270
A-B	99	54.0	53.64	-0.36	0.560

A+B: calc. WL 1.12 CL 1.68 actual WL 1.50 CL 2.30

A-B: calc. WL 1.12 CL 1.68 actual WL 1.50 CL 2.30

Std. Dev.: within, S_w= 0.396 between, S = 0.694 S/S_w = 1.75

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	27	60	54	141
Std. Dev.:	0.241	0.520	0.808	0.664
Mean:	14.2	41.9	85.9	53.5

% RSD: 1.11% Detection Criteria: 0.40

Test Name: CHLORIDE

Lab.: DW

Units: mg/L

Period: from 03/07/80 to 30/12/80

Sample Type: Domestic Water, Sewage, Industrial Wastes

Sample Preparation: Sewage samples and others in which sulphide is suspected are pretreated by lowering the pH to ≃2 with nitric acid and aerating for 10 minutes.

Analytical Procedure: An automatically pipetted aliquot (10 mL) is titrated with 0.0564N silver nitrate in the presence of acetone and nitric acid to the -110 mv endpoint. Blank compensation is attained by mv setting.

Instrumentation: Radiometer ATS-1 with Radiometer TTT2 titrator equipped with a mercuric sulphate reference electrode and a silver bullet electrode. Buret capacity = 2.50 mL; setting for delivery rate = 20; delay at the endpoint = 3 seconds.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.8 to 500	-	0.2	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	84	170.0	170.52	0.52	1.225
B	84	17.0	17.53	0.53	0.549
Long Term Blank:					
A+B	84	187.0	188.05	1.05	1.567
A-B	84	153.0	152.99	-0.01	1.072

A+B: calc. WL 2.15 CL 3.22 actual WL 2.70 CL 4.00

A-B: calc. WL 2.15 CL 3.22 actual WL 2.70 CL 4.00

Std. Dev.: within, S_w = 0.758 between, S = 0.949 S/S_w = 1.25

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
$R_1 + R_2$					
$R_1 - R_2$					

$R_1 + R_2$ calc. WL CL actual WL CL

$R_1 - R_2$ calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	197	22	4	223
Std. Dev.:	0.489	0.617	1.38	0.518
Mean:	20.1	161	301	39.1

% RSD: 0.37% **Detection Criteria:** 0.81

Test Name: COLOUR - APPARENT

Lab.: DW

Units: Hazen Units (HU)

Period: from 07/07/80 to 30/12/80

Sample Type: Domestic Waters, Sewages, Industrial Wastes.

Sample Preparation: When the colour exceeds the calibrated range, the sample is centrifuged and the test is repeated on the supernatant or its dilution. Such results are reported as True Colour.

Analytical Procedure: For each sample, two absorbance values are recorded using different filters. The absorbance value for the longer wavelength is utilized to estimate particulate contribution to the apparent colour. The apparent colour (0 - 70 HU) is calculated from the two values using an empirically derived equation.

Instrumentation: Two Klett Summerson Colorimeters, one with a #42 broadband filter (400 - 450 nm) and the otherwith a #69 filter (660 - 740 nm); 4 cm cell path length.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
1.3 - 70	-	1	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	25.0	23.57	-1.43	1.450
B	17	2.5	1.54	-0.96	0.184
Long Term Blank:					
A+B	17	27.5	24.16	-3.34	1.573
A-B	17	22.5	21.07	-1.43	1.574

A+B: calc. WL 3.2 CL 4.8 actual WL - CL -

A-B: calc. WL 3.2 CL 4.8 actual WL - CL -

Std. Dev.: within, S_w= 1.113 between, S = 1.113 S/S_w = 1.00

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
$R_1 + R_2$					
$R_1 - R_2$					

$R_1 + R_2$ calc. WL CL actual WL CL

$R_1 - R_2$ calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	116	42	13	171
Std. Dev.:	0.798	1.07	1.09	0.913
Mean:	4.32	21.5	51.6	12.1

% RSD: 2.1% Detection Criteria: 1.3

Test Name: CONDUCTIVITY

Lab.: DW

Units: µS/cm

Period: from 02/07/80 to 31/12/80

Sample Type: Domestic Water

Sample Preparation:

Analytical Procedure: Samples are introduced into the jacketed conductivity cell and equilibrated to 25 ^{0}C.

Instrumentation: Radiometer CDM3 conductivity meter with a 324 jacketed conductivity cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<5000	5000	50	0
<500	500	5	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	114	1398.9	1364.5	-34.4	11.19
B	114	477.4	458.9	-18.5	5.42
Long Term Blank:					
A+B	114	1876.3	1823.5	-52.8	13.84
A-B	114	921.5	905.6	-15.9	10.85
A+B: calc. WL	21.7	CL 32.6	actual WL 30.0	CL 45.0	
A-B: calc. WL	21.7	CL 32.6	actual WL 30.0	CL 45.0	

Std. Dev.: within, S_w = 7.67 between, S = 8.79 S/S_w = 1.15

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	113	477.4	473.09	-4.31	5.389
D	113	193.4	189.92	-3.48	1.946
Long Term Blank:					
C+D	113	670.8	663.01	-7.79	6.432
C-D	113	284.0	283.17	-0.83	4.930
C+D: calc. WL	9.6	CL 14.8	actual WL 8.20	CL 12.3	
C-D: calc. WL	9.6	CL 14.8	actual WL 8.20	CL 12.3	

Std. Dev.: within, S_w = 3.486 between, S = 4.052 S/S_w = 1.16

Range <5000

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	89	25	5	119
Std. Dev.:	3.50	6.78	11.5	5.83
Mean:	659	1710	3540	1000
% RSD: 0.31%		Detection Criteria: -		

Range <500

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	35	40	79	154
Std. Dev.:	0.763	1.26	2.14	1.72
Mean:	75.8	183	269	254
% RSD: 0.57%		Detection Criteria: -		

Test Name: FLUORIDE

Lab.: DW

Units: mg/L

Period: from 08/07/80 to 23/12/80

Sample Type:

Sample Preparation: Domestic Water, Sewage, Industrial Wastes

Analytical Procedure: The sample is distilled at 160°C in an automated AAII system and the distillate is reacted with alizarin fluorine blue - lanthanum reagents to form a blue complex.

Instrumentation: Basic AAII AutoAnlyzer system plus a distillation unit. Std Cal = 1.32; 1.5 cm flow cell; 630 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.01 to 2.00	0 - 0.8 Abs.	0.02	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	33	1.50	1.506	0.006	0.0202
B	33	0.30	0.308	0.008	0.0187
Long Term Blank:					
A+B	33	1.80	1.814	0.014	0.0341
A-B	33	1.20	1.198	-0.002	0.0187

A+B: calc. WL 0.037 CL 0.056 actual WL 0.050 CL 0.080

A-B: calc. WL 0.037 CL 0.056 actual WL 0.050 CL 0.080

Std. Dev.: within, S_w= 0.0132 between, S = 0.0194 S/S_w = 1.47

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	56	12	5	73
Std. Dev.:	0.007	0.015	0.013	0.009
Mean:	0.138	0.723	1.19	0.307

% RSD: 0.8% **Detection Criteria:** 0.011

Test Name: HARDNESS **Lab.:** DW

Units: mg/L as $CaCO_3$ **Period:** from 02/07/80 to 30/12/80

Sample Type: Domestic Waters, Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: Manually pipetted sample aliquots (50 mL) are automatically titrated with 0.01M EDTA to the eriochrome black T endpoint as detected by the instrument's photsensors. The molarity of the EDTA is determined by standardization against a standard 0.01M $CaCO_3$ solution.

Instrumentation: Radiometer PMT1 Phototitrator and Autoburette ABU1C. Buret volume = 25.0; rate of titrant delivery setting = 2; delay at endpoint setting = 2; program setting = 597 to 650 - 086 - 24.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.4 to 500	-	0.1	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	101	232.5	232.57	0.07	1.101
B	101	93.0	94.13	1.13	0.790
Long Term Blank:	-	-	-	-	-
A+B	101	325.5	326.70	1.20	1.578
A-B	101	139.5	138.44	-1.06	1.088

A+B: calc. WL 2.18 CL 3.26 actual WL 2.00 CL 3.00

A-B: calc. WL 2.18 CL 3.26 actual WL 2.00 CL 3.00

Std. Dev.: within, S_w = 0.769 between, S = 0.958 S/S_w = 1.25

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	53	86	66	205
Std. Dev.:	0.242	0.283	1.05	0.670
Mean:	42.3	164	330	187

% RSD: 0.28% **Detection Criteria:** 0.4

Test Name: IRON

Units: mg/L

Lab.: DW

Period: from 02/07/80 to 23/12/80

Sample Type: Domestic Water, Sewage

Sample Preparation:

Analytical Procedure: Samples are autoclaved at 121° C for 60 minutes in a sulphuric acid hydroxylamine media. The digested sample is then introduced to the AutoAnalyzer system where total iron is determined by formation of the ferrous - TPTZ complex in a buffered system.

Instrumentation: Autoclave, basic AAI AutoAnalyzer system.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.04 - 2.00	-	0.02	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	36	1.40	1.383	-0.017	0.0190
B	36	0.28	0.271	-0.009	0.0198
Long Term Blank:					
A+B	36	1.68	1.654	-0.026	0.0316
A-B	36	1.12	1.113	-0.007	0.0225

A+B: calc. WL 0.045 CL 0.068 actual WL 0.060 CL 0.090

A-B: calc. WL 0.045 CL 0.068 actual WL 0.060 CL 0.090

Std. Dev.: within, S_w = 0.0159 between, S = 0.0194 S/S_w = 1.22

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	26	1.40	1.448	0.048	0.0326
R_2	23	0.28	0.307	0.027	0.0189
Digested Blanks:					
R_1+R_2	23	1.68	1.753	0.073	0.0454
R_1-R_2	23	1.12	1.140	0.020	0.0298

R_1+R_2 calc. WL 0.060 CL 0.090 actual WL - CL -

R_1-R_2 calc. WL 0.060 CL 0.090 actual WL - CL -

Std. Dev.: within, S_w = 0.210 between, S = 0.0271 S/S_w = 1.29

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	67	9	4	80
Std. Dev.:	0.027	0.120	0.050	0.054
Mean:	0.101	0.664	1.54	0.237

% RSD: 3.3% **Detection Criteria:** 0.044

Test Name: NITRATE PLUS NITRITE

Lab.: DW

Units: mg/l as N

Period: from 08/07/80 to 23/12/80

Sample Type: Domestic waters.

Sample Preparation: Samples are not filtered.

Analytical Procedure: In an AAII system, nitrate is reduced to nitrite by hydrazine sulphate using copper as a catalyst. Nitrate plus nitrite is determined by formation of an azo dye using sulphanilamide and N(1-naphtyl) ethylenediamine dihydrochloride. To control metal interferences, samples are passed through an Amberlite IR-120(H) ion exchange column prior to the reduction step.

Instrumentation: Basic AAII AutoAnalyzer system plus a heating bath (7.7 mL delay coil at 38^0 C); 50 nm flow cell; 520 nm; Std Cal ≃ 2.3).

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.1 to 20.0	0 - 0.6 Abs.	0.2	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	29	15.0	15.01	0.01	0.114
B	29	3.0	2.93	-0.07	0.072
Long Term Blank:					
A+B	29	18.0	17.94	-0.06	0.135
A-B	29	12.0	12.08	0.08	0.135

A+B: calc. WL 0.27 CL 0.41 actual WL 0.30 CL 0.40

A-B: calc. WL 0.27 CL 0.41 actual WL 0.30 CL 0.40

Std. Dev.: within, S_w = 0.096 between, S = 0.096 S/S_w = 1.00

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	41	10	2	53
Std. Dev.:	0.051	0.085	0.000	0.059
Mean:	0.727	6.29	13.5	2.26
% RSD:	-			

Detection Criteria: 0.084

Test Name: pH

Units: pH units

Lab.: DW

Period: from 03/07/80 to 31/12/80

Sample Type: Domestic water

Sample Preparation:

Analytical Procedure: pH is measured directly on a stirred aliquot of sample at room temperature.

Instrumentation: Radiometer pHM63 meter with glass and reference electrodes.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
6.5 - 9.0	-	0.01	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	114	9.00	8.970	-0.030	0.0247
B	114	4.00	3.975	-0.025	0.0314
Long Term Blank:					
A+B	114	13.00	12.944	-0.056	0.0449
A-B	114	5.00	4.995	-0.005	0.0343

A+B: calc. WL 0.07 CL 0.10 actual WL 0.08 CL 0.12

A-B: calc. WL 0.07 CL 0.10 actual WL 0.08 CL 0.12

Std. Dev.: within, S_w= 0.0242 between, S = 0.0282 S/S_w = 1.17

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	40	219	259
Std. Dev.:	-	0.072	0.061	0.063
Mean:	-	6.64	7.79	7.62

% RSD: - Detection Criteria: -

Test Name: POTASSIUM - HIGH RANGE **Lab.:** DW

Units: mg/L as K **Period:** from 12/02/80 to 30/12/80

Sample Type: Domestic Waters, Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 766.5 nm with an air acetylene flame. Cesium and dilution are introduced in an automated sampling train. Chart recorder results are converted to concentration by means of a chart strip reader.

Instrumentation: Gilson sampler, Gilson peristaltic pump, Varian AA5 (AAS) Linear chart recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
10.0 - 40.0	0 - 0.5 ABS.*	0.4	2

* Set automatically regardless of the metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	45	26.0	26.03	0.03	0.220
B	44	6.5	6.51	0.01	0.111
Long Term Blank:					
A+B	44	32.5	32.53	0.03	0.258
A-B	44	19.5	19.50	0.00	0.225

A+B: calc. WL 0.45 CL 0.68 actual WL 0.50 CL 0.70

A-B: calc. WL 0.45 CL 0.68 actual WL 0.50 CL 0.70

Std. Dev.: within, S_w = 0.159 between, S = 0.171 S/S_w = 1.07

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	6	3	9
Std. Dev.:	-	0.138	0.306	0.213
Mean:	-	14.9	27.8	19.2

% RSD: - Detection Criteria: -

Test Name: POTASSIUM - LOW RANGE

Lab.: DW

Units: mg/L as K

Period: from 12/02/80 to 30/12/80

Sample Type: Domestic Water, Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: as per High Range.

Instrumentation: as per High Range but with a 4x scale expansion at the recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.2 to 10.0	0 - 0.5 Abs.*	0.1	1

* Set automatically regardless of the metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	44	6.50	6.473	-0.027	0.0943
D	44	1.30	1.325	0.025	0.0448
Long Term Blank:					
C+D	44	7.80	7.798	-0.002	0.1173
C-D	44	5.20	5.149	-0.051	0.0897

C+D: calc. WL 0.18 CL 0.27 actual WL 0.20 CL 0.30

C-D: calc. WL 0.18 CL 0.27 actual WL 0.20 CL 0.30

Std. Dev.: within, S_w = 0.0635 between, S = 0.0738 S/S_w = 1.16

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	73	31	12	116
Std. Dev.:	0.166	0.108	0.075	0.146
Mean:	1.13	3.13	6.97	2.27

% RSD: 1.0% **Detection Criteria:** 0.27

Test Name: SODIUM - HIGH RANGE **Lab.:** DW

Units: mg/L **Period:** from 03/07/80 to 30/12/80

Sample Type: Domestic Waters, Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: Samples are analyzed at 589.5 nm with an air-acetylene flame. Potassium and dilution are introduced in an automated sampling train. Chart recorder results are converted to concentration by means of a chart strip reader.

Instrumentation: Gilson sampler, Gilson peristaltic pump. Varian AA5 (AAS), Linear chart recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
50 to 200.0	0 - 0.5 ABS.*	2	2

* Set automatically regardless of the metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	24	130.0	130.94	0.94	1.499
B	24	32.5	32.73	0.23	0.361
Long Term Blank:					
A+B	24	162.5	163.67	1.17	1.698
A-B	24	97.5	98.21	0.71	1.367

A+B: calc. WL 2.73 CL 4.10 actual WL 3.30 CL 4.90

A-B: calc. WL 2.73 CL 4.10 actual WL 3.30 CL 4.90

Std. Dev.: within, S_w = 0.966 between, S = 1.090 S/S_w = 1.13

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R 1					
R 2					
Digested Blanks:					
R 1+R 2					
R 1-R 2					

R 1+R 2 calc. WL CL actual WL CL

R 1-R 2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	5	7	12
Std. Dev.:	-	0.447	1.55	1.28
Mean:	-	74.4	126	105

% RSD: 2.1% Detection Criteria: -

Test Name: SODIUM - LOW RANGE **Lab.:** DW

Units: mg/L **Period:** from 03/07/80 to 30/12/80

Sample Type: Domestic Water, Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: as per High Range

Instrumentation: as per High Range but with a 4x expansion at the recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.25 to 50.0	0 - 0.5 Abs.*	0.5	1

* Set automatically regardless of the metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	25	32.5	32.61	0.11	0.446
B	25	6.5	6.50	0.00	0.166
Long Term Blank:					
A+B	25	39.0	39.11	0.11	0.532
A-B	25	26.0	26.11	0.11	0.412

A+B: calc. WL 0.82 CL 1.24 actual WL 0.80 CL 1.20

A-B: calc. WL 0.82 CL 1.24 actual WL 0.80 CL 1.20

Std. Dev.: within, S_w= 0.291 between, S = 0.336 S/S_w = 1.16

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	24	19	13	56
Std. Dev.:	0.153	0.370	0.487	0.347
Mean:	4.72	18.5	34.8	16.4

% RSD: 1.30% **Detection Criteria:** 0.25

Test Name: SULPHATE

Lab.: DW

Units: mg/L as SO_4

Period: from 02/07/80 to 30/12/80

Sample Type: Domestic Waters, Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: In an AAI system, cations are removed with an Amberlite 1R 120(H) ion exchange resin. Sulphate is then determined by the methyl thymol blue method.

Instrumentation: Basic AAI AutoAnalyzer system plus ion exchange column. 50 mm flow cell; 460 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
1.1 to 100	-	1	8

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	26	58.0	58.59	0.59	1.241
B	26	11.6	11.48	-0.12	0.600
Long Term Blank:					
A+B	26	69.6	70.07	0.47	1.606
A-B	26	46.4	47.10	0.70	1.104

A+B: calc. WL 2.21 CL 3.31 actual WL 2.00 CL 3.00

A-B: calc. WL 2.21 CL 3.31 actual WL 2.00 CL 3.00

Std. Dev.: within, S_w = 0.781 between, S = 0.974 S/S_w = 1.25

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	32	27	7	66
Std. Dev.:	0.665	1.09	1.21	1.04
Mean:	8.66	35.6	69.1	26.1

% RSD: 1.6% **Detection Criteria:** 1.09

Test Name: TURBIDITY

Lab.: DW

Units: FTU

Period: from 02/07/80 to 31/12/80

Sample Type: Domestic Water, Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: The turbidity of a sample is measured by a nephelometer using sealed standards as controls. These standards are prepared from latex polymers of known size and are rated in Formazin Turbidity Units.

Instrumentation: Hach Model 2100A Turbidimeter; the stirrer is not operated.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
1	-	0.01	1
10	-	0.1	1
100	-	1.0	1
1000	-	10	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A					
B					
Long Term Blank:			NO DATA		
A+B					
A-B					
A+B: calc. WL		CL	actual WL	CL	
A-B: calc. WL		CL	actual WL	CL	
Std. Dev.: within, S_w=		between, S =		S/S_w =	

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					
R_1+R_2 calc. WL		CL	actual WL	CL	
R_1-R_2 calc. WL		CL	actual WL	CL	
Std. Dev.: within, S_w=		between, S =		S/S_w =	

Range 0 - 200

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	209	2	3	214
Std. Dev.:	0.310	0.00	0.00	0.356
Mean:	2.24	51.0	187	5.28
% RSD:	-			

Detection Criteria: 0.51

PRECIPITATION

LABORATORY

Test Name: ACIDITY

Units: mg/L as $CaCO_3$

Lab.: PR

Period: from 12/09/80 to 31/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: Sample aliquots (100 mL) are titrated with 0.01N sodium hydroxide to a pH endpoint of 8.3. The titrant normality is determined by titrating 0.005N KHP to the same pH 8.3 endpoint. Titrant delivery is controlled by the first derivative of the titration curve and the stability of the pH readings following each aliquot of titrant.

Instrumentation: pHM64 pH meter; ABU80 autoburette, TRS-80; in-house interface box.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<10.0	-	0.005	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	57	25.0	25.04	0.04	0.267
B	56	10.0	10.96	0.96	0.270
Long Term Blank:					
A+B	56	35.0	36.00	1.00	0.409
A-B	56	15.0	14.00	-0.92	0.346

A+B: calc. WL 0.69 CL 1.0 actual WL 0.70 CL 1.00

A-B: calc. WL 0.69 CL 1.0 actual WL 0.70 CL 1.00

Std. Dev.: within, S_w = 0.245 between, S = 0.268 S/S_w = 1.10

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	1	4	3	8
Std. Dev.:	-	0.009	0.229	0.155
Mean:	1.15	4.07	6.15	4.49

% RSD: 3% **Detection Criteria:** -

Test Name: CALCIUM

Lab.: PR

Units: mg/L

Period: from 05/01/80 to 31/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 422.7 nm with an air-acetylene flame. Lanthanum (in dilute HCl solution) is introduced with an automated sampling train. Chart recorder results are converted to concentration by means of manually prepared calibration curves.

Instrumentation: Technicon Large Industrial Model Sampler; Gilson peristaltic pump; Varian AA175 (AAS), Linear recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.02 to 2.00	0.17 Abs.	0.02	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	36	1.20	1.218	0.018	0.0227
B	36	0.20	0.198	-0.002	0.0115
Long Term Blank:					
A+B	36	1.40	1.416	0.016	0.0283
A-B	36	1.00	1.020	0.020	0.0221

A+B: calc. WL 0.044 CL 0.066 actual WL 0.040 CL 0.060

A-B: calc. WL 0.044 CL 0.066 actual WL 0.040 CL 0.060

Std. Dev.: within, S_w= 0.156 between, S = 0.180 S/S_w = 1.15

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	25	10	5	40
Std. Dev.:	0.011	0.026	0.031	0.021
Mean:	0.187	0.690	1.44	0.470

% RSD: 2.1% Detection Criteria: 0.019

Test Name: CHLORIDE - DIONEX - AUTOMATED **Lab.:** PR

Units: mg/L **Period:** 08/01/80 to 30/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: Chloride is separated from other anions in the sample by ion chromatography using a mixture of 0.003M sodium bicarbonate and a 0.0024M sodium carbonate as the eluent. After conversion to the acid form, the concentration of chloride is determined from the conductivity of the hydrochloric acid produced. Manually drawn calibration curves are used.

Instrumentation: Dionex Ion Chromatography Model 10 modified to be compatible with an automated sampling train. Technicon sampler; AAI peristaltic pump; timer (Supergrator III); and control box (in-house design); Linear recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.03 to 1.50	0 - 10 µS/cm	0.02	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	138	1.20	1.196	-0.004	0.0200
B	138	0.30	0.296	-0.004	0.0133
Long Term Blank:					
A+B	136	1.50	1.492	-0.008	0.0255
A-B	136	0.90	0.900	0.000	0.0219
A+B: calc. WL	0.044	CL 0.066	actual WL -	CL -	
A-B: calc. WL	0.044	CL 0.066	actual WL -	CL -	

Std. Dev.: within, S_w = 0.0155 between, S = 0.0168 S/S_w = 1.09

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					
R_1+R_2 calc. WL		CL	actual WL	CL	
R_1-R_2 calc. WL		CL	actual WL	CL	

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	17	9	8	34
Std. Dev.:	0.015	0.013	0.012	0.014
Mean:	0.160	0.501	1.04	0.457

% RSD: 1.0% **Detection Criteria:** 0.025

Test Name: CHLORIDE - DIONEX - MANUAL

Lab.: PR

Units: mg/L

Period: from 30/06/80 to 19/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: as per Automated procedure.

Instrumentation: Dionex Ion Chromatograph Models 10 and 16; Linear recorder

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.05 to 1.50	0 - 10 µS/cm	0.02	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	66	1.20	1.190	-0.010	0.0301
B	66	0.30	0.298	-0.002	0.0149
Long Term Blank:					
A+B	66	1.50	1.488	-0.012	0.0357
A-B	66	0.90	0.892	-0.008	0.0312

A+B: calc. WL 0.06 CL 0.09 actual WL - CL -

A-B: calc. WL 0.06 CL 0.09 actual WL - CL -

Std. Dev.: within, S_w= 0.0221 between, S = 0.0237 S/S_w = 1.07

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	4	25	3	32
Std. Dev.:	0.028	0.105	0.070	0.096
Mean:	0.265	0.477	1.25	0.523

% RSD: 6.2% **Detection Criteria:** 0.046

Test Name: CONDUCTIVITY

Lab.: PR

Units: µS/cm

Period: from 10/01/80 to 25/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: The sample is introduced into a jacketed conductivity cell and equilibrated to 25 °C.

Instrumentation: Radiometer CDM3 Conductivity meter with a 324 jacketed conductivity cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0 - 100	0 - 150	1.5	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	54	73.90	73.819	-0.081	1.7389
B	54	14.94	16.471	1.531	0.6523
Long Term Blank:					
A+B	54	88.84	90.270	1.430	1.8851
A-B	54	58.96	57.367	-1.593	1.8222

A+B: calc. WL 3.64 CL 5.47 actual WL 3.75 CL 5.64

A-B: calc. WL 3.64 CL 5.47 actual WL 3.75 CL 5.64

Std. Dev.: within, S_w = 1.2885 between, S = 1.3109 S/S_w = 1.02

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	14	44	4	62
Std. Dev.:	0.260	0.401	0.408	0.370
Mean:	10.5	35.5	67.5	31.9

% RSD: 3.6% **Detection Criteria:** 0.304*

* Based on old data.

Test Name: FLUORIDE - DIONEX - AUTOMATED

Lab.: PR

Units: mg/L

Period: from 07/01/80 to 31/07/80*

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: Fluoride is separated from other anions in the sample by ion chromatography using a mixture of 0.003M sodium bicarbonate and 0.0024M sodium carbonate as the eluent. After conversion to the acid form, the concentration is estimated by measuring the conductivity of the hydrofluoric acid produced. Manually drawn calibration curves are used.

Instrumentation: Dionex Ion Chromatograph Model 10 modified to be compatible with an automated sampling train. Technicon sampler; AA-1 peristaltic pump, timer (Supergrator III); control box (in-house design) Linear recorder.

* Test is no longer run in this laboratory.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.01 to 0.400	0 - 10 µS/cm	0.004	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	80	0.32	0.322	0.002	0.0046
B	79	0.08	0.082	0.002	0.0027
Long Term Blank:					
A+B	79	0.40	0.404	0.004	0.0047
A-B	79	0.24	0.240	0.000	0.0039
A+B: calc. WL	0.008	CL 0.012	actual WL -	CL -	
A-B: calc. WL	0.008	CL 0.012	actual WL -	CL -	

Std. Dev.: within, S_w = 0.0028 between, S = 0.0031 S/S_w = 1.10

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					
R_1+R_2 calc. WL		CL	actual WL	CL	
R_1-R_2 calc. WL		CL	actual WL	CL	

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	26	1	0	27
Std. Dev.:	0.007	-	-	0.007
Mean:	0.027	0.142	0	0.032
% RSD: -		Detection Criteria:	0.012	

Test Name: MAGNESIUM

Units: mg/L

Lab.: PR

Period: from 29/05/80 to 22/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 285.2 nm with an air-acetylene flame. Lanthanum in dilute HCl solution is added by an automated sampling train. Chart recorder results are converted to concentration by means of manually prepared calibration curves.

Instrumentation: Technicon Sampler; Gilson peristaltic pump; Varian AA275 (AAS); Linear recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.01 to 0.50	0 - 0.4 Abs.	0.005	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	21	0.300	0.2936	-0.0064	0.00504
B	21	0.050	0.0467	-0.0033	0.00289
Long Term Blank:					
A+B	21	0.350	0.3402	-0.0098	0.00602
A-B	21	0.250	0.2469	-0.0031	0.00558

A+B: calc. WL 0.011 CL 0.017 actual WL 0.010 CL 0.015

A-B: calc. WL 0.011 CL 0.017 actual WL 0.010 CL 0.015

Std. Dev.: within, S_w = 0.00395 between, S = 0.00410 S/S_w = 1.04

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	10	6	0	16
Std. Dev.:	0.003	0.002	-	0.003
Mean:	0.056	0.186	-	0.105
% RSD:	-			

Detection Criteria: 0.004

Test Name: NITRATE - DIONEX - AUTOMATED

Lab.: PR

Units: mg/L as N

Period: from 02/01/80 to 30/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: Nitrate is separated from other anions in the sample by ion chromatography using a mixture of 0.003M sodium bicarbonate and 0.0024M sodium carbonate as the eluent. After conversion to the acid form nitrate is estimated by measuring the conductivity of the nitric acid produced. Manually drawn calibration curves are used.

Instrumentation: Dionex Ion Chromatograph Model 10 modified to be compatible with an automated sampling train. Technicon sampler; AA-1 peristaltic pump; timer (Supergrator III); control box (in-house design); Linear recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.02 to 2.00	0 - 10.0 µS/cm	0.02	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	167	1.60	1.603	0.003	0.0199
B	165	0.40	0.404	0.004	0.0097
Long Term Blank:					
A+B	165	2.00	2.007	0.007	0.0267
A-B	165	1.20	1.198	-0.002	0.0168

A+B: calc. WL 0.03 CL 0.05 actual WL - CL -

A-B: calc. WL 0.03 CL 0.05 actual WL - CL -

Std. Dev.: within, S_w= 0.0119 between, S = 0.0158 S/S_w = 1.33

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	12	19	13	44
Std. Dev.:	0.010	0.016	0.032	0.022
Mean:	0.247	0.704	1.37	0.776

% RSD: 2.1% **Detection Criteria:** 0.016

Test Name: pH

Units: pH units

Lab.: PR

Period: from 02/01/80 to 31/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: pH is directly measured on a stirred aliquot of sample (100 mL) at room temperature. Stirring rate, beaker size, degree of electrode immersion and temperature range are all strictly defined. For samples with low volumes, the test is done in 20 mL plastic sample cups with stirring.

Instrumentation: Radiometer pHM64 meter with a combination electrode (GK2401C).

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
3.50 - 7.00	-	0.001	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	110	6.86	6.950	-0.001	0.0092
B	108	4.008	4.008	0.000	0.0081
Long Term Blank:					
A+B	108	10.87	10.867	-0.001	0.0140
A-B	108	2.85	3.851	-0.001	0.0101

A+B: calc. WL 0.020 CL 0.030 actual WL 0.020 CL 0.030

A-B: calc. WL 0.020 CL 0.030 actual WL 0.020 CL 0.030

Std. Dev.: within, S_w = 0.0072 between, S = 0.0086 S/S_w = 1.21

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Range 0 - 14

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	3	0	3
Std. Dev.:	-	0.023	-	0.023
Mean:	-	4.37	-	4.37

% RSD: - Detection Criteria: -

Test Name: POTASSIUM

Lab.: PR

Units: mg/L

Period: from 28/05/80 to 22/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 766.5 nm with an air-acetylene flame. Cesium, is introduced by an automated sampling train. Chart recorder results are converted to concentraion using manually prepared calibration curves.

Instrumentation: Technicon sampler; Gilson peristaltic pump; Varian AA275 (AAS); Linear recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.02 to 1.00	0 - 0.4 Abs.	0.01	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	21	0.60	0.603	0.003	0.0066
B	21	0.10	0.097	-0.003	0.0056
Long Term Blank:					
A+B	21	0.70	0.700	0.000	0.0107
A-B	21	0.50	0.506	0.006	0.0059

A+B: calc. WL 0.012 CL 0.018 actual WL 0.020 CL 0.030

A-B: calc. WL 0.012 CL 0.018 actual WL 0.020 CL 0.030

Std. Dev.: within, S_w= 0.0042 between, S = 0.0061 S/S_w = 1.47

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	16	3	2	21
Std. Dev.:	0.012	0.015	0.014	0.013
Mean:	0.079	0.340	0.635	0.169

% RSD: 1.9% Detection Criteria: 0.02

Test Name: SODIUM

Lab.: PR

Units: mg/L

Period: from 16/01/80 to 31/12/80

Sample Type: Precipitation

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 589.5 nm with an air-acetylene flame. Potassium is added with an automated sampling train. Chart recorder results are converted to concentration using manually prepared calibration curves.

Instrumentation: Technicon sampler; Gilson peristaltic pump; Varian AA-275 (AAS); Linear recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.01 to 1.00	0 - 0.5 Abs.	0.01	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	36	0.60	0.600	0.000	0.0061
B	37	0.10	0.098	-0.002	0.0055
Long Term Blank:					
A+B	36	0.70	0.699	-0.001	0.0083
A-B	36	0.50	0.502	0.002	0.0082

A+B: calc. WL 0.016 CL 0.025 actual WL 0.020 CL 0.030

A-B: calc. WL 0.016 CL 0.025 actual WL 0.020 CL 0.030

Std. Dev.: within, S_w = 0.0058 between, S = 0.0059 S/S_w = 1.01

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	29	9	1	39
Std. Dev.:	0.007	0.013	-	0.009
Mean:	0.071	0.286	0.700	0.137
% RSD: -				

Detection Criteria: 0.011

Test Name: SULPHATE - DIONEX - AUTOMATED **Lab.:** PR

Units: mg/L as SO_4 **Period:** from 02/01/80 to 30/12/80

Sample Type: Precipitation; some Rivers, Lakes

Sample Preparation:

Analytical Procedure: Sulphate is separated from other anions in the sample by ion chromatography using a mixture of 0.003M sodium bicarbonate and 0.0024M sodium carbonate as the eluent. After conversion to the acid form, the concentration of sulphate is determined from the conductivity of the sulphuric acid produced. Manually drawn concentration curves are used.

Instrumentation: Dionex Ion Chromatograph Model 10 modified to be compatible with an automated sampling train. Technicon sampler, AA-1 peristaltic pump; a timer (Supergrator III); control box (in-house design); Linear recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.07 to 10.0	0 - 10 µS/cm	0.1	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	177	8.0	7.99	-0.01	0.081
B	177	2.0	2.02	0.02	0.047
Long Term Blank:					
A+B	177	10.0	10.01	0.01	0.106
A-B	177	6.0	5.97	-0.03	0.080

A+B: calc. WL 0.16 CL 0.24 actual WL - CL -

A-B: calc. WL 0.16 CL 0.24 actual WL - CL -

Std. Dev.: within, S_w = 0.057 between, S = 0.067 S/S_w = 1.17

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	15	31	7	53
Std. Dev.:	0.040	0.108	0.104	0.095
Mean:	1.16	3.10	5.93	2.92

% RSD: 1.3% **Detection Criteria:** 0.07

Test Name: SULPHATE - DIONEX - MANUAL

Lab.: PR

Units: mg/L as SO_4

Period: from 30/06/80 to 19/12/80

Sample Type: Precipitation, some Rivers, Lakes

Sample Preparation:

Analytical Procedure: as per Automated procedure

Instrumentation: Dionex Ion Chromatograph Models 10 and 16. Linear recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.33 to 10.0	0 - 10 μ S/cm	0.1	6

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	80	8.0	7.98	-0.02	0.102
B	80	2.0	2.04	0.04	0.064
Long Term Blank:					
A+B	80	10.0	10.03	0.03	0.125
A-B	80	6.0	5.94	-0.06	0.116

A+B: calc. WL 0.23 CL 0.35 actual WL - CL -

A-B: calc. WL 0.23 CL 0.35 actual WL - CL -

Std. Dev.: within, S_w = 0.082 between, S = 0.085 S/S_w = 1.04

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
$R_1 + R_2$					
$R_1 - R_2$					

$R_1 + R_2$ calc. WL CL actual WL CL

$R_1 - R_2$ calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	4	13	43	60
Std. Dev.:	0.202	0.086	0.198	0.174
Mean:	0.631	3.98	7.26	6.11

% RSD: 2.6% **Detection Criteria:** 0.33

RIVERS AND LAKES

LABORATORY

(MINERAL UNIT)

Test Name: ALKALINITY - TIP

Lab.: RL

Units: mg/L as $CaCO_3$

Period: from 01/01/80 to 31/12/80

Sample Type: Rivers, Lakes, precipitation

Sample Preparation:

Analytical Procedure: Samples (100 mL) are manually pipetted and titrated with 0.020N sulphuric acid to a pH endpoint of 3.75 with a computer controlled titration system. The titration data is then subjected to a Gran analysis.

Instrumentation: Radio Shack TRS-80 microcomputer system; Radiometer pHM64 pH meter with a combination electrode; ABU-13 Autoburette; in-house interface and program.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<25	-	0.01	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	-	-	-	-	-
B	-	-	-	-	-
Long Term Blank:	-	-	-	-	-
A+B	-	-	-	-	-
A-B	-	-	-	-	-

A+B: calc. WL CL actual WL CL

A-B: calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	-	-	-	-
Std. Dev.:	-	-	-	-
Mean:	-	-	-	-

% RSD: - Detection Criteria: -

Test Name: ALKALINITY - TFE

Lab.: RL

Units: mg/L as $CaCO_3$

Period: from 05/02/80 30/06/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Samples (10mL) are automatically pipetted by the instrument and titrated with 0.020N sulphuric acid to a pH endpoint of 4.5.

Instrumentation: Radiometer ATS-1 with a Radiometer Titrator TTT2, pH meter, ABU-13 and glass and calomel electrodes. Buret volume = 2.5 mL; proportional band = 1; rate of delivery setting = 20; delay at the endpoint is 3 seconds.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
1.1 to 200	-	0.1	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	54	-	90.19	-	0.785
B	54	-	45.93	-	0.497
Long Term Blank:	53	-	3.94	-	1.06
A+B	54	-	136.12	-	1.154
A-B	54	-	44.26	-	0.629

A+B: calc. WL	1.26	CL	1.89	actual WL	1.60	CL	2.40
A-B: calc. WL	1.26	CL	1.89	actual WL	1.60	CL	2.40

Std. Dev.: within, S_w = 0.445 between, S = 0.657 S/S_w = 1.48

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL	CL	actual WL	CL
R_1-R_2 calc. WL	CL	actual WL	CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	71	52	33	156
Std. Dev.:	0.658	0.673	1.72	1.02
Mean:	14.3	95.8	169	74.24

% RSD: 1.1% Detection Criteria: 1.08

Test Name: CALCIUM - HIGH RANGE

Lab.: RL

Units: mg/L

Period: from 15/02/80 to 26/11/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 442.7 nm with an air acetylene flame. Lanthanum, acid and dilution are all added via an automated sampling train. Chart recorder results are converted to concentration with a digitizer.

Instrumentation: Gilson sampler, Technicon pump; Pye-Unicam SP1900 (AAS); Linear chart recorder; HP9825-A computer system plus digitizer.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
20.0 to 100	0 - 0.5 Abs.*	1.0	6

* Set automatically regardless of the concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	29	72.0	71.06	-0.94	0.992
B	29	28.8	28.70	-0.10	0.468
Long Term Blank:					
A+B	29	100.8	99.76	-1.04	1.203
A-B	29	43.2	42.35	-0.85	0.979

A+B: calc. WL 1.96 CL 2.94 actual WL 0.86 CL 1.30

A-B: calc. WL 1.96 CL 2.94 actual WL 0.86 CL 1.30

Std. Dev.: within, S_w = 0.692 between, S = 0.776 S/S_w = 1.12

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	36	24	60
Std. Dev.:	-	1.92	1.38	1.73
Mean:	-	36.3	67.5	48.8

% RSD: 1.8% Detection Criteria: -

Test Name: CALCIUM - LOW RANGE

Lab.: RL

Units: mg/L

Period: from 30/01/80 to 19/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: As per High Range

Instrumentation: As per High Ranges but with a modified manifold.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.5 to 20.0	0 - 0.5 Abs.*	0.2	6

* Set automatically regardless of the metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	54	14.40	14.27	-0.13	0.320
B	54	5.76	5.72	-0.04	0.204
Long Term Blank:					
A+B	54	20.16	19.99	-0.17	0.480
A-B	54	8.64	8.54	-0.10	0.239

A+B: calc. WL 0.48 CL 0.72 actual WL 0.21 CL 0.32

A-B: calc. WL 0.48 CL 0.72 actual WL 0.21 CL 0.32

Std. Dev.: within, S_w= 0.169 between, S = 0.268 S/S_w = 1.59

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	109	20	21	150
Std. Dev.:	0.221	0.334	0.325	0.274
Mean:	2.83	6.35	15.8	5.12

% RSD: 2.2% Detection Criteria: 0.36

Test Name: CHLORIDE - HIGH RANGE

Lab.: RL

Units: mg/L

Period: from 04/01/80 to 28/03/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Using an AAII system, a sample is mixed with saturated mercuric thiocyanate to displace thiocyanate quantitatively. The thiocyanate subsequently reacts with ferric ions in acid media to produce a red colored ferric thiocyanate. A reference stream in which the mercuric thiocyanate is replaced with distilled water is used to eliminate color interference from the sample.

Instrumentation: Basic AAII AutoAnalyzer system. Std Cal (Std dev) = 3.21 (0.095); 470 nm; 15 mm flow cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
10.0 - 50.0	0 - 0.5 Abs.*	0.5	2

* 15 mm flow cell.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	89	25.0	25.66	0.66	0.314
B	88	5.0	5.34	0.34	0.167
Long Term Blank:	103	-	0.001	-	0.008
A+B	88	30.0	31.00	1.00	0.402
A-B	88	20.0	20.32	0.32	0.306

A+B: calc. WL 0.61 CL 0.92 actual WL 0.54 CL 0.81

A-B: calc. WL 0.61 CL 0.92 actual WL 0.54 CL 0.81

Std. Dev.: within, S_w = 0.216 between, S = 0.253 S/S_w = 1.17

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	60	48	108
Std. Dev.:	-	0.169	0.245	0.207
Mean:	-	17.6	31.9	23.9

% RSD: 0.65%

Detection Criteria: -

Test Name: CHLORIDE - LOW RANGE

Lab.: RL

Units: mg/L

Period: from 02/07/80 to 31/12/80

Sample Type: Rivers, Lakes

Sample Preparation: As per High Range.

Analytical Procedure: As per High Range.

Instrumentation: As per High Range but with a 3x scale expansion at the recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.2 to 10.00	0 - 0.2 Abs.*	0.1	2

* 15 mm flow cell

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	87	5.00	5.042	0.042	0.0771
D	87	4.00	4.032	0.032	0.0605
Long Term Blank:	103	-	0.001	-	0.0082
C+D	87	9.00	9.074	0.074	0.1345
C-D	87	1.00	1.010	-0.010	0.0334

C+D: calc. WL 0.067 CL 0.100 actual WL 0.180 CL 0.280

C-D: calc. WL 0.067 CL 0.100 actual WL 0.180 CL 0.280

Std. Dev.: within, S_w = 0.0236 between, S = 0.0693 S/S_w = 2.94

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	47	34	32	113
Std. Dev.:	0.108	0.090	0.187	0.132
Mean:	0.956	4.18	6.63	3.53
% RSD: 2.5%				

Detection Criteria: 0.18

Test Name: TOTAL IRON

Units: mg/L

Sample Type: Rivers, Lakes

Sample Preparation:

Lab.: RL

Period: from 01/01/80 to 31/03/80 and from 02/07/80 to 10/10/80

Analytical Procedure: Samples are autoclaved at 121 °C for 60 minutes in a sulphuric acid hydroxylamine media. The digested sample is then introduced into an AAII system where total iron is determined by formation of the ferrous-TPTZ complex in a buffered system. Total manganese is measured simultaneously.

Instrumentation: Basic AAII AutoAnalyzer system plus an autoclave; Std Cal (Std dev) = 1.37 (0.16); 600 nm; 50 mm flow cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.04 to 1.00	0 - 0.14 Abs.	0.01	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	50	0.60	0.604	0.004	0.0072
B	50	0.40	0.404	0.004	0.0068
Long Term Blank:	50	-	0.007	-	0.0076
A+B	50	1.00	1.01	0.01	0.0118
A-B	50	0.20	0.200	0.00	0.0075

A+B: calc. WL 0.013 CL 0.020 actual WL 0.020 CL 0.030

A-B: calc. WL 0.013 CL 0.020 actual WL 0.020 CL 0.030

Std. Dev.: within, S_w = 0.0047 between, S = 0.0068 S/S_w = 1.47

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	68	0.80	0.827	0.027	0.0211
R_2	33	0.20	0.213	0.013	0.0122
Digested Blanks:	34	0	<0.01	-	-
R_1+R_2	17	1.00	1.048	0.048	0.0307
R_1-R_2	17	0.60	0.619	0.019	0.0270

R_1+R_2 calc. WL 0.054 CL 0.081 actual WL - CL -

R_1-R_2 calc. WL 0.054 CL 0.081 actual WL - CL -

Std. Dev.: within, S_w = 0.0191 between, S = 0.0205 S/S_w = 1.07

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	108	22	11	141
Std. Dev.:	0.025	0.057	0.019	0.042
Mean:	0.073	0.334	0.676	0.161

% RSD: 2.5% Detection Criteria: 0.041

Test Name: MAGNESIUM - HIGH RANGE

Lab.: RL

Units: mg/L

Period: from 15/02/80 to 26/11/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 285.2 nm with an air-acetylene flame. Lanthanum, acid and dilution are added by an automated sampling train. Chart recorder results are converted to concentration with a digitizer.

Instrumentation: Gilson sampler; Technicon pump; Pye Unicam SP 1900 (AAS); Linear chart recorder; HP9825A computer system plus digitizer.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
5.00 to 50.0	0 - 0.5 Abs.*	0.5	6

* Set automatically regardless of the metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	24	36.0	34.13	-1.87	0.483
B	25	14.4	13.82	-0.58	0.289
Long Term Blank:					
A+B	25	50.4	48.03	-2.37	0.799
A-B	25	21.6	20.39	-1.21	0.554

A+B: calc. WL 1.11 CL 1.66 actual WL 0.40 CL 0.60

A-B: calc. WL 1.11 CL 1.66 actual WL 0.40 CL 0.60

Std. Dev.: within, S_w = 0.392 between, S = 0.486 S/S_w = 1.24

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R1					
R2					
Digested Blanks:					
R1 +R2					
R1 -R2					

R1 +R2 calc. WL CL actual WL CL

R1 -R2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	33	21	4	58
Std. Dev.:	0.384	0.816	1.225	0.685
Mean:	7.54	17.6	32.8	12.9

% RSD: 3.3%

Detection Criteria: -

Test Name: MAGNESIUM - LOW RANGE

Lab.: RL

Units: mg/L

Period: from 30/01/80 to 20/09/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: As per High Range.

Instrumentation: As per High Range but with a slight manifold change.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.14 to 5.00	0 - 0.5 Abs.*	0.05	6

* Set automatically regardless of the metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	42	3.60	3.262	-0.338	0.2456
B	42	1.44	1.275	-0.165	0.0749
Long Term Blank:					
A+B	42	5.04	4.537	-0.503	0.3032
A-B	42	2.16	1.987	-0.173	0.1999

A+B: calc. WL 0.40 CL 0.60 actual WL 0.074 CL 0.110

A-B: calc. WL 0.40 CL 0.60 actual WL 0.074 CL 0.110

Std. Dev.: within, S_w = 0.1414 between, S = 0.1816 S/S_w = 1.28

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	77	27	18	122
Std. Dev.:	0.0831	0.0488	0.110	0.085
Mean:	0.669	1.65	3.47	1.300

% RSD: 3.1% Detection Criteria: 0.14

Test Name: TOTAL MANGANESE

Lab.: RL

Units: mg/L

Period: from 02/07/80 to 31/12/80

Sample Type: Rivers, Lakes, some Domestic Waters

Sample Preparation:

Analytical Procedure: Samples are autoclaved at 121 °C for 60 minutes in a sulphuric acid-hydroxylamine media and the tubes are presented to an AA-II system. Manganese is determined by measuring the manganese-formaldoxime complex in a buffered system designed to suppress interferences from cations such as iron. A reference channel, based on inverted order of reagent addition, compensates for sample matrix effects.

Instrumentation: Basic AA-II AutoAnalyzer system plus an autoclave. Std Cal (Std dev) = 3.55 (0.44) 50 mm flow cell; 480 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.002 to 0.200	0 to 0.07 Abs.	0.002	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	55	0.120	0.1177	-0.0023	0.00173
B	53	0.080	0.0789	0.0011	0.00130
Long Term Blank:	61	-	0.0005	-	0.0005
A+B	53	0.200	0.1966	-0.0034	0.00291
A-B	53	0.040	0.0388	-0.0012	0.00103

A+B: calc. WL 0.002 CL 0.003 actual WL 0.005 CL 0.008

A-B: calc. WL 0.002 CL 0.003 actual WL 0.005 CL 0.008

Std. Dev.: within, S_w = 0.00073 between, S = 0.00154 S/S_w = 2.12

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	217	0.160	0.1608	0.0008	0.00499
R_2	110	0.040	0.0399	-0.0001	0.00189
Digested Blanks:	117	-	0.0005	-	0.0005
R_1+R_2	55	0.200	0.2004	-0.0004	0.00641
R_1-R_2	55	0.120	0.1204	0.0004	0.00461

R_1+R_2 calc. WL 0.005 CL 0.008 actual WL - CL -

R_1-R_2 calc. WL 0.005 CL 0.008 actual WL - CL -

Std. Dev.: within, S_w = 0.00326 between, S = 0.00395 S/S_w = 1.21

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	62	29	8	99
Std. Dev.:	0.0011	0.0014	0.0029	0.0015
Mean:	0.0158	0.0693	0.1481	0.0422

% RSD: 1.9% **Detection Criteria:** 0.0018

Test Name: POTASSIUM - HIGH RANGE

Lab.: RL

Units: mg/L as K

Period: from 07/07/80 to 18/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 766.5 nm with an air-acetylene flame. Cesium is used as a suppressant and is added along with dilution via an automated sampling train. Chart recorder results are converted to concentration by means of a digitizer and a computer program.

Instrumentation: Gilson sampler, Technicon pump, Pye Unicam SP1900 (AAS), Linear chart recorder; HP 9825A computer system plus digitizer.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.2 to 10.0	0.5 Abs.*	0.1	6

* Set automatically regardless of metal concentration

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	7	7.20	7.57	0.37	0.603
B	7	2.88	2.90	0.02	0.114
Long Term Blank:	-	-	-	-	-
A+B	7	10.08	10.47	0.39	0.674
A-B	7	4.32	4.67	0.35	0.547

A+B: calc. WL 1.09 CL 1.64 actual WL 0.28 CL 0.42

A-B: calc. WL 1.09 CL 1.64 actual WL 0.28 CL 0.42

Std. Dev.: within, S_w = 0.387 between, S = 0.434 S/S_w = 1.12

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	6	4	5	15
Std. Dev.:	0.137	0.196	0.205	0.181
Mean:	1.58	2.19	7.07	3.77

% RSD: 2.7% Detection Criteria: 0.22

Test Name: POTASSIUM - LOW RANGE

Lab.: RL

Units: mg/l as K

Period: from 04/01/80 to 18/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: As per High Range.

Instrumentation: As per High Range but with a slightly altered manifold.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.09 to 5.00	0 - 0.5 Abs.*	0.05	6

* Set automatically regardless of metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	51	3.60	3.597	-0.003	0.0725
B	51	1.44	1.471	0.031	0.0314
Long Term Blank:					
A+B	51	5.04	5.068	0.024	0.0867
A-B	51	2.16	2.126	-0.034	0.0704

A+B: calc. WL 0.14 CL 0.21 actual WL 0.068 CL 0.102

A-B: calc. WL 0.14 CL 0.21 actual WL 0.068 CL 0.102

Std. Dev.: within, S_w= 0.0498 between, S = 0.0559 S/S_w = 1.12

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	119	30	13	162
Std. Dev.:	0.054	0.087	0.080	0.065
Mean:	0.512	1.73	3.95	1.01
% RSD:				

Detection Criteria: 0.088

Test Name: SILICON

Lab.: RL

Units: mg/L as Si

Period: from 03/07/80 to 31/12/80

Sample Type: Rivers, Lakes

Sample Preparation: Samples must be collected in plastic bottles.

Analytical Procedure: Silicate is determined by formation of a reduced molybdo silicate complex at pH 12. Ascorbic acid is the reducing agent and oxalic acid is added to prevent phosphate interference. Silicon is analyzed simultaneously with chloride.

Instrumentation: Basic AA-II AutoAnalyzer system. Std Cal (Std dev) = 1.79 (.098); 660 nm; 50 mm flow cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.08 - 5.00	0 - 0.7 Abs.	0.05	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	89	2.50	2.590	0.090	0.0357
B	89	0.50	0.502	0.002	0.0099
Long Term Blank:		-		-	
A+B	89	3.00	3.092	0.092	0.0372
A-B	89	2.00	2.088	0.088	0.0368

A+B: calc. WL 0.074 CL 0.110 actual WL 0.070 CL 0.100

A-B: calc. WL 0.074 CL 0.110 actual WL 0.070 CL 0.100

Std. Dev.: within, S_w = 0.0260 between, S = 0.0262 S/S_w = 1.01

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	123	71	45	239
Std. Dev.:	0.051	0.044	0.088	0.056
Mean:	0.407	1.59	3.40	1.32

% RSD: 2.3% **Detection Criteria:** 0.08

Test Name: SODIUM - HIGH RANGE

Lab.: RL

Units: mg/L as Na

Period: from 10/06/80 to 18/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Samples are analyzed by AAS at 589.5 nm with an air acetylene flame. Cesium is added as a suppressant and is added along with dilution in an automated sampling train. Chart recorder readings are converted to concentration by means of a digitizer and a computer program.

Instrumentation: Gilson sampler, Technicon pump. Pye Unicam SP 1900 (AAS), Linear chart recorder; HP 9825A computer system plus digitizer.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
10.0 - 100	0 - 0.5 Abs.*	1.0	6

* Set automatically regardless of metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	8	72.0	71.93	-0.07	0.830
B	8	28.8	29.26	0.46	0.607
Long Term Blank:					
A+B	8	100.8	101.19	0.39	1.343
A-B	8	43.2	42.67	-0.53	0.558

A+B: calc. WL 1.12 CL 1.67 actual WL 0.60 CL 0.90

A-B: calc. WL 1.12 CL 1.67 actual WL 0.60 CL 0.90

Std. Dev.: within, S_w= 0.394 between, S = 0.727 S/S_w = 1.84

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	8	7	3	18
Std. Dev.:	0.744	0.816	1.53	0.981
Mean:	13.8	36.9	88.3	35.2
% RSD: 2.0				

Detection Criteria: -

Test Name: SODIUM - LOW RANGE

Lab.: RL

Units: mg/L as Na

Period: from 04/01/80 to 18/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: As per High Range.

Instrumentation: As per High Range but with a slightly altered manifold.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.2 to 10.0	0 - 0.5 Abs.*	0.1	6

* Set automatically regardless of metal concentration.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	46	7.20	7.05	-0.15	0.128
B	46	2.88	2.86	-0.02	0.070
Long Term Blank:					
A+B	46	10.08	9.91	-0.17	0.152
A-B	46	4.32	4.19	-0.13	0.139

A+B: calc. WL 0.28 CL 0.42 actual WL 0.15 CL 0.23

A-B: calc. WL 0.28 CL 0.42 actual WL 0.15 CL 0.23

Std. Dev.: within, S_w = 0.099 between, S = 0.103 S/S_w = 1.04

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	111	13	12	136
Std. Dev.:	0.119	0.144	0.195	0.139
Mean:	0.993	3.34	7.73	1.81

% RSD: 2.6%

Detection Criteria: 0.20

Test Name: SOLIDS - DISSOLVED

Units: mg/L

Lab.: RL

Period: from 01/10/80 to 22/12/80 and 02/07/80 to 15/08/80

Sample Type: Rivers, Lakes.

Sample Preparation: Samples are filtered through Reeve Angel 934-AH glass fiber filters.

Analytical Procedure: Sample aliquots (50 ml) are dried in pre-weighed crucibles for 18 hours at 103-105 °C and reweighed. The dissolved solids are then calculated by difference.

Instrumentation: Mettler H54 5-place balance, Coors porcelain evaporating dishes, filtering apparatus, desiccators, drying oven.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<1000	-	0.2	0

Quality Control Data:

	Number of datums	Theoretical Concentration (mg)	Concentration Found (mg)	Ave. Bias	Std. Dev.
A	36	50.00	50.000314	-	0.000053
B	36	10.00	9.999818	-	0.000151
Long Term Blank:					
A+B	36	60.00	60.000141	-	0.000169
A-B	36	40.00	40.000504	-	0.000130

A+B: calc. WL	0.00026	CL	0.00039	actual WL	0.0040	CL	0.0060
A-B: calc. WL	0.00026	CL	0.00039	actual WL	0.0040	CL	0.0060

Std. Dev.: within, S_w = 0.00009 between, S = 0.00010 S/S_w = 1.15

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL	CL	actual WL	CL	
R_1-R_2 calc. WL	CL	actual WL	CL	

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	2	75	17	94
Std. Dev.:	1.98	12.4	4.76	10.8
Mean:	199	339	674	397

% RSD: 0.64% **Detection Criteria:** -

Test Name: SOLIDS - SUSPENDED

Units: mg/L

Sample Type: Rivers, Lakes

Lab.: RL

Period: from 01/10/80 22/12/80 and 02/07/80 to 22/08/80

Sample Preparation: Certain studies may require special sampling bottles.

Analytical Procedure: Appropriate aliquots (25-500 ml) of samples are filtered through pre-washed and weighed Reeve-Angel 934 AH glass fiber filters. After drying at 103-105°C the papers are reweighed. The suspended solids content is calculated by difference.

Instrumentation: Sartorius 1802 6-place modified balance or 5-place Mettler on occasion; drying oven, desiccator.

Calibration:

Conc. Range	Operating Scale	Resolution *	#Stds.
< 100	-	0.005 or 0.05	0

* Depends on the type of balance used.

Quality Control Data:

	Number of datums	Theoretical Concentration (mg)	Concentration Found (mg)	Ave. Bias	Std. Dev.
A	43	100.000	100.0340	0.0340	0.02863
B	43	20.000	19.9619	-0.0381	0.02978
Long Term Blank:					
A+B	43	120.000	119.9958	-0.0042	0.04463
A-B	43	80.000	80.0721	0.0721	0.03771

A+B: calc. WL 0.075 CL 0.113 actual WL 0.100 CL 0.150

A-B: calc. WL 0.075 CL 0.113 actual WL 0.100 CL 0.150

Std. Dev.: within, S_w = 0.02666 between, S = 0.02921 S/S_w = 1.10

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
$R_1 + R_2$					
$R_1 - R_2$					

$R_1 + R_2$ calc. WL CL actual WL CL

$R_1 - R_2$ calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	89	20	2	111
Std. Dev.:	2.00	2.66	-	2.25
Mean:	7.02	36.2	64.3	13.3
% RSD: -		Detection Criteria:	3.29	

Test Name: SULPHATE

Lab.: RL

Units: mg/L as SO_4

Period: from 03/07/80 to 19/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Via an AA-II system, the sample is passed through an Amberlite IR120(H) ion exchange resin to remove cation interferences. Sulphate is then determined using the methylthymol blue procedure.

Instrumentation: Basic AA-II AutoAnalyzer system. Std Cal (Std dev) = 5.13 (0.23); 460 nm; 50 mm flow cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
1.0 to 50.0	0 - 0.25 Abs.	0.5	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	66	25.0	25.08	0.08	0.449
B	66	5.0	5.07	0.07	0.176
Long Term Blank:	66	-	0.08	-	0.181
A+B	66	30.0	30.15	0.15	0.542
A-B	66	20.0	20.02	0.02	0.413

A+B: calc. WL 0.82 CL 1.24 actual WL 0.95 CL 1.43

A-B: calc. WL 0.82 CL 1.24 actual WL 0.95 CL 1.43

Std. Dev.: within, S_w = 0.292 between, S = 0.341 S/S_w = 1.17

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	46	92	42	180
Std. Dev.:	0.643	0.679	0.433	0.623
Mean:	7.80	14.9	34.4	17.6

% RSD: 1.23% Detection Criteria: 1.05

RIVERS AND LAKES

LABORATORY

(NUTRIENTS UNIT)

Test Name: AMMONIUM AND AMMONIA - HIGH SCALE **Lab.:** RL

Units: mg/L as N **Period:** from 03/07/80 to 30/12/80

Sample Type: Rivers, Lakes, Precipitation

Sample Preparation: Samples are manually filtered in the laboratory with Reeve-Angel 934-AH glass fibre filters. Precipitation samples are not filtered.

Analytical Procedure: Ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst. A reference stream which differs from the sample stream by replacement of the catalyst with an equal flow of distilled water is employed to blank out the effects of sample color. Nitrate plus nitrite, nitrite and filtered reactive phosphorus are run simultaneously.

Instrumentation: Basic AA-II AutoAnalyzer system plus heating bath module (7.7 ml delay coil at 38 C). Std Cal (std dev) = 3.26 (0.54) flow cells = 50 mm; 630 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.40 - 2.00	0 - 0.5 Abs.	0.02	4

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	93	1.50	1.477	-0.023	0.0196
B	93	0.50	0.485	-0.015	0.0101
Long Term Blank:	92	-	0.0082	-	0.0019
A+B	93	2.00	1.963	-0.037	0.0274
A-B	93	1.00	0.992	-0.008	0.0149

A+B: calc. WL 0.030 CL 0.045 actual WL 0.040 CL 0.060

A-B: calc. WL 0.030 CL 0.045 actual WL 0.040 CL 0.060

Std. Dev.: within, S_w = 0.0105 between, S = 0.0156 S/S_w = 1.48

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R^1					
R^2					
Digested Blanks:					
R^1+R^2					
R^1-R^2					

R^1+R^2 calc. WL CL actual WL CL

R^1-R^2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	3	5	8
Std. Dev.:	-	0.010	0.0396	0.034
Mean:	-	0.742	1.36	1.13
% RSD: -		Detection Criteria: -		

Test Name: AMMONIUM AND AMMONIA - LOW RANGE **Lab.:** RL

Units: mg/L as N **Period:** from 01/10/80 to 30/12/80

Sample Type: Rivers, Lakes, Precipitation

Sample Preparation: As per High Range

Analytical Procedure: As per High Range

Instrumentation: As per High Range but with a 5x expansion at the recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.006 - 0.400	0 - 0.1 Abs.	0.004	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	92	0.300	0.3009	0.0009	0.00536
D	93	0.100	0.1062	0.0062	0.00364
Long Term Blank:	92	-	0.0082	-	0.0186
C+D	92	0.400	0.4072	0.0072	0.00740
C-D	92	0.200	0.1947	-0.0053	0.00543

C+D: calc. WL 0.011 CL 0.016 actual WL 0.008 CL 0.012

A-B: calc. WL 0.011 CL 0.016 actual WL 0.008 CL 0.012

Std. Dev.: within, S_w = 0.00384 between, S = 0.00459 S/S_w = 1.20

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R^1					
R^2					
Digested Blanks:					
R^1+R^2					
R^1-R^2					

R^1+R^2 calc. WL CL actual WL CL

R^1-R^2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	147	33	11	191
Std. Dev.:	0.004	0.006	0.009	0.005
Mean:	0.032	0.121	0.303	0.063
% RSD: 3%		Detection Criteria: 0.006		

Test Name: TOTAL KJELDAHL NITROGEN

Lab.: RL

Units: mg/L as N

Period: from 02/07/80 to 30/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using two block digesters kept at 200 C and 360 C. The digestate is pH adjusted in line and the ammonia content is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst. Total phosphorus is analyzed simultaneously.

Instrumentation: Basic AAII AutoAnalyzer system plus two Technicon BD40 block digesters plus a heating bath module (7.7 ml delay coil ast 38 C). Std cal (std dev) = 3.01 (0.466); 630 nm; 1.5 cm flow cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.04 to 2.00	0 to 0.5 Abs.	0.02	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	95	1.50	1.509	0.009	0.0172
B	95	0.50	0.494	-0.006	0.0100
Long Term Blank:	89	-	0.004	-	0.0138
A+B	95	2.00	2.003	0.003	0.0217
A-B	95	1.00	1.014	0.014	0.0179

A+B: calc. WL 0.036 CL 0.054 actual WL 0.040 CL 0.060

A-B: calc. WL 0.036 CL 0.054 actual WL 0.040 CL 0.060

Std. Dev.: within, S_w = 0.0127 between, S = 0.0141 S/S_w = 1.11

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R^1	188	1.40	1.399	-0.001	0.0294
R^2	190	0.84	0.842	0.002	0.0221
Digested Blanks:	95	-	0.0181	-	0.0127
R^1+R^2	95	2.24	2.240	0.000	0.0437
R^1-R^2	95	0.56	0.552	-0.008	0.0305

R^1+R^2 calc. WL 0.062 CL 0.092 actual WL - CL -

R^1-R^2 calc. WL 0.062 CL 0.092 actual WL - CL -

Std. Dev.: within, S_w = 0.0216 between, S = 0.0266 S/S_w = 1.24

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	249	91	15	355
Std. Dev.:	0.022	0.022	0.032	0.023
Mean:	0.254	0.620	1.32	0.393

% RSD: 2.13%

Detection Criteria: 0.036

Test Name: NITRATE & NITRITE - HIGH SCALE

Lab.: RL

Units: mg/L as N

Period: from 02/07/80 to 30/12/80

Sample Type: Rivers, Lakes

Sample Preparation: Samples are manually filtered in the laboratory with Reeve-Angel 934 AH glass fibre filters.

Analytical Procedure: In an AA-II system, nitrate is reduced to nitrite by hydrazine sulphate with copper as a catalyst. Nitrate plus nitrite are then determined by formation of an azo dye using sulphanilamide and N(1-naphthyl) ethylenediamine dihydrochloride. To control metal ion interferences, samples are passed through an Amberlite IR-120(H) ion exchange column prior to the reduction step.

Instrumentation: Basic AA-II AutoAnalyzer system plus a heating bath (7.7 ml delay coil at 38 C). Std cal (std dev) = 2.80 (0.42); 50 mm flow cell; 520 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
1.00 - 5.00	0 - 0.5 Abs.	0.05	4

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	97	3.75	3.769	0.019	0.0712
B	97	1.25	1.285	0.035	0.0273
Long Term Blank:	96	-	0.0042	-	0.0045
A+B	97	5.00	5.054	0.054	0.0885
A-B	97	2.50	2.485	-0.015	0.0618

A+B: calc. WL 0.125 CL 0.185 actual WL 0.100 CL 0.150

A-B: calc. WL 0.125 CL 0.185 actual WL 0.100 CL 0.150

Std. Dev.: within, S_w = 0.0437 between, S = 0.0540 S/S_w = 1.23

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	2	32	9	43
Std. Dev.:	0.035	0.034	0.182	0.090
Mean:	1.013	1.59	3.65	1.99

% RSD: 4.9%

Detection Criteria: -

Test Name: NITRATE PLUS NITRITE - LOW SCALE

Lab.: RL

Units: mg/l as N

Period: from 02/07/80 to 30/12/80

Sample Type: Rivers, Lakes

Sample Preparation: as per High scale.

Analytical Procedure: as per High scale.

Instrumentation: as per High scale but with a 5x expansion at the interface.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.01 to 1.00	0 - 0.1 Abs.	0.01	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	97	0.750	0.7540	0.0040	0.01363
D	95	0.250	0.2498	-0.0002	0.00855
Long Term Blank:	96	-	0.0042	-	0.0045
C+D	95	1.000	1.0045	0.0045	0.01822
C-D	95	0.500	0.5048	0.0048	0.00952

C+D: calc. WL 0.020 CL 0.030 actual WL 0.020 CL 0.030

C-D: calc. WL 0.020 CL 0.030 actual WL 0.020 CL 0.030

Std. Dev.: within, S_w = 0.00673 between, S = 0.01028 S/S_w = 1.53

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R1					
R2					
Digested Blanks:					
R1+R2					
R1-R2					

R1+R2 calc. WL CL actual WL CL

R1-R2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	106	43	25	174
Std. Dev.:	0.0081	0.0119	0.0092	0.0095
Mean:	0.063	0.328	0.727	0.224

% RSD: 1.2% **Detection Criteria:** 0.013

Test Name: NITRITE

Lab.: RL

Units: mg/L as N

Period: from 02/07/80 to 30/12/80

Sample Type: Rivers and Lakes

Sample Preparation: Samples are manually filtered in the laboratory with Reeve-Angel 934-AH glass fibre filters.

Analytical Procedure: Nitrite is determined by formation of an azo dye using sulphanilamide and N(1-naphthyl)-ethylenediamine dihydrochloride. Nitrate plus nitrite, ammonia, and filtered reactive phosphorus are run simultaneously.

Instrumentation: Basic AA-II AutoAnalyzer system plus filtration apparatus. Std cal(Std dev) - 3.98 (0.027); 50 mm flow cell; 520 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.002 to 0.100	0 - 0.4 Abs.	0.001	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	99	0.075	0.0748	-0.0002	0.00129
D	99	0.025	0.0266	0.0016	0.00116
Long Term Blank:	99	-	0.0011	-	0.0007
C+D	99	0.100	0.1014	0.0014	0.00214
C-D	99	0.050	0.0482	-0.0018	0.00119

C+D: calc. WL 0.002 CL 0.004 actual WL 0.0020 CL 0.0030

C-D: calc. WL 0.002 CL 0.004 actual WL 0.0020 CL 0.0030

Std. Dev.: within, S_w = 0.00084 between, S = 0.00122 S/S_w = 1.46

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R1					
R2					
Digested Blanks:					
R1+R2					
R1-R2					

R1+R2 calc. WL CL actual WL CL

R1-R2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	190	26	9	225
Std. Dev.:	0.0011	0.0016	0.0014	0.0012
Mean:	0.006	0.031	0.065	0.011

% RSD: 1.86% Detection Criteria: 0.0018

Test Name: FILTERED REACTIVE PHOSPHORUS **Lab.:** RL

Units: mg/L as P **Period:** from 02/07/80 to 30/12/80

Sample Type: Rivers, Lakes

Sample Preparation: Samples are manually filtered in the laboratory with Reeve-Angel 934-AH glass fibre filters.

Analytical Procedure: Orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex in a continuous flow system. Ascorbic acid is the reducing agent.

Instrumentation: Basic AA-II AutoAnalyzer system plus filtration apparatus. Std Cal(Std dev) = 7.66 (0.17); 50 mm flow cell, 880 nm; special phototubes.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.003 - 0.100	0 - 0.2 Abs.	0.001	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	99	0.075	0.0749	-0.0001	0.00183
D	96	0.025	0.0264	0.0014	0.00136
Long Term Blank:	104	-	0.0016	-	0.0017
C+D	96	0.100	0.1013	0.0013	0.00264
C-D	96	0.050	0.0485	-0.0015	0.00185

C+D: calc. WL 0.004 CL 0.006 actual WL 0.002 CL 0.003

C-D: calc. WL 0.004 CL 0.006 actual WL 0.002 CL 0.003

Std. Dev.: within, S_w= 0.00131 between, S = 0.00161 S/S_w = 1.23

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	161	20	15	196
Std. Dev.:	0.0018	0.0021	0.0035	0.0020
Mean:	0.006	0.031	0.062	0.012

% RSD: 0.47% Detection Criteria: 0.0029

Test Name: TOTAL PHOSPHORUS

Units: mg/L as P

Lab.: RL

Period: from 02/07/80 to 30/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using two block digesters maintained at 200°C and 360°C. The pH is neutralized in line and the orthophosphate content in the digestate is determined by formation of a reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Instrumentation: Basic AA-II AutoAnalyzer plus two Technicon DB-40 block digesters. Std Cal(Std dev) = 4.16 (0.18)); 50 mm flow cells, 880 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.003 to 0.200	0 - 0.36 Abs.	0.002	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	0.150	0.1518	0.0018	0.00129
B	94	0.050	0.0507	0.0007	0.00098
Long Term Blank:	93	-	0.0004	-	0.0008
A+B	94	0.200	0.2025	0.0025	0.00194
A-B	94	0.100	0.1011	0.0011	0.00123

A+B: calc. WL 0.002 CL 0.004 actual WL 0.004 CL 0.006

A-B: calc. WL 0.002 CL 0.004 actual WL 0.004 CL 0.006

Std. Dev.: within, S_w = 0.00087 between, S = 0.00115 S/S_w = 1.32

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	181	0.140	0.1409	0.0009	0.00457
R_2	178	0.084	0.0857	0.0017	0.00396
Digested Blanks:	83	-	0.0033	-	0.0035
R_1+R_2	91	0.224	0.2269	0.0029	0.00866
R_1-R_2	91	0.056	0.0552	-0.0008	0.00355

R_1+R_2 calc. WL 0.007 CL 0.011 actual WL CL

R_1-R_2 calc. WL 0.007 CL 0.011 actual WL CL

Std. Dev.: within, S_w = 0.00251 between, S = 0.00468 S/S_w = 1.87

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	266	50	12	328
Std. Dev.:	0.0020	0.0028	0.0038	0.0023
Mean:	0.017	0.066	0.142	0.029

% RSD: 2.5%

Detection Criteria: 0.003

Test Name: FILTERED TOTAL PHOSPHORUS - HIGH RANGE **Lab.:** RL

Units: µg/L as P **Period:** from 15/01/80 to 23/12/80

Sample Type: Rivers, Lakes, Special Studies

Sample Preparation: as per Low Range

Analytical Procedure: as per Low Range

Instrumentation: as per Low Range, but there is only a 1.2x expansion at the recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
20 - 200	0 - 0.3 Abs.	2	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	65	150	153.4	3.4	3.52
B	65	50	49.8	-0.2	1.45
Long Term Blank:	61	-	0.17	-	0.157
A+B	60	200	203.1	3.1	3.80
A-B	60	100	103.6	3.6	3.86
A+B: calc. WL 7.7		CL 11.6	actual WL 4.0	CL 6.0	
A-B: calc. WL 7.7		CL 11.6	actual WL 4.0	CL 6.0	

Std. Dev.: within, S_w = 2.73 between, S = 2.71 S/S_w = 0.99

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	112	140	141.7	1.7	2.94
R_2	110	70	69.9	-0.1	2.81
Digested Blanks:	156	-	1.35	-	2.29
R_1+R_2	56	210	211.6	1.6	5.21
R_1-R_2	56	70	71.9	1.9	2.39
R_1+R_2 calc. WL 4.8		CL 7.2	actual WL -	CL -	
R_1-R_2 calc. WL 4.8		CL 7.2	actual WL -	CL -	

Std. Dev.: within, S_w = 1.69 between, S = 2.87 S/S_w = 2.69

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	9	11	3	23
Std. Dev.:	2.19	2.34	6.93	3.48
Mean:	28.89	65.32	139.83	60.78
% RSD: 4.62%		Detection Criteria: -		

Test Name: FILTERED TOTAL PHOSPHORUS - LOW RANGE **Lab.:** RL

Units: µg/L as P **Period:** from 15/01/80 to 23/12/80

Sample Type: Rivers, Lakes, Special Studies

Sample Preparation: Samples must be collected in Pyrex culture tubes with Teflon liners. Samples must be filtered in the field with Sartorius CA 0.45 µ membrane filters (no spacers).

Analytical Procedure: Samples are autoclaved for 60 minutes in a sulphuric acid-potassium persulphate media at 121 °C in the collection tubes. The tubes are then presented to the AutoAnalyzer system. Orthophosphate in the digestate is determined by formation of a reduced phospho-antimonyl-molybdate complex. Ascorbic acid is the reducing agent.

Instrumentation: Autoclave plus basic AA-II AutoAnalyzer system; Std cal (Std dev) = 4.00 (0.27); scale expansion = 12x with respect to Technicon recorder; flow cell = 50 mm; 880 nm; special phototubes.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
1.2 to 20.0	0 - 0.03 Abs.*	0.2	2

* Including scale expansion at recorder

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	62	15.0	15.39	0.39	0.521
D	61	5.0	5.58	0.58	0.564
Long Term Blank:	61	-	1.35	-	0.157
C+D	56	20.0	20.93	0.93	0.722
C-D	56	10.0	9.77	-0.23	0.795

C+D: calc. WL 1.6 CL 2.4 actual WL 0.60 CL 0.90

C-D: calc. WL 1.6 CL 2.4 actual WL 0.60 CL 0.90

Std. Dev.: within, S_w = 0.562 between, S = 0.537 S/S_w = 0.96

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_3	105	14.0	14.47	0.47	1.079
R_4	110	7.0	7.44	0.44	0.740
Digested Blanks:	156	-	1.35	-	2.29
R_3+R_4	53	21.0	22.02	1.02	1.657
R_3-R_4	53	7.0	7.11	0.11	0.658

R_3+R_4 calc. WL 1.3 CL 2.0 actual WL - CL -

R_3-R_4 calc. WL 1.3 CL 2.0 actual WL - CL -

Std. Dev.: within, S_w = 0.465 between, S = 0.892 S/S_w = 1.92

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	63	51	33	147
Std. Dev.:	0.753	0.999	2.39	1.39
Mean:	2.52	7.14	15.0	6.92
% RSD: 15.9%		Detection Criteria: 1.24		

RIVERS AND LAKES

LABORATORY

(ORGANIC UNIT)

Test Name: BIOCHEMICAL OXYGEN DEMAND **Lab.:** RL

Units: mg/L as BOD **Period:** from 14/05/80 to 24/12/80

Sample Type: Rivers and Lakes

Sample Preparation: pH may be adjusted to neutral and chlorine may be removed by reaction with sodium thiosulphate.

Analytical Procedure: The oxygen depletion for samples stored in the dark at 20^0C for a 5 day period is measured. If necessary, samples are diluted with nutrient enriched water to get an approximate oxygen depletion of between 50 and 75%. If the sample has undergone any of the preparation steps listed above, a sewage seed is added.

Instrumentation: Weston and Stack Oxygen Analyzer which measures oxygen diffusion across a 0.5 mil thick Teflon membrane. The analyzer is calibrated against the Winkler Titration.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<10	-	0.05	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	30	217	195.2	-21.8	12.22
B	-	-	-	-	-
BOD Water Blank:	68	-	0.43	-	0.20
A+B	-	-	-	-	-
A-B	-	-	-	-	-

A+B: calc. WL CL actual WL CL

A-B: calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R1					
R2					
Digested Blanks:					
R1+R2					
R1-R2					

R1+R2 calc. WL CL actual WL CL

R1-R2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	81	20	10	111
Std. Dev.:	0.275	0.205	0.163	0.256
Mean:	1.03	3.37	6.00	1.90

% RSD: 2.1% Detection Criteria: 0.45

Test Name: CARBON - DISSOLVED INORGANIC **Lab.:** RL

Units: mg/L **Period:** from 0/01/80 to 30/12/80

Sample Type: Rivers, Lakes, Domestic Waters, some Sewage samples.

Sample Preparation: Sewage samples may undergo a clean-up step prior to analysis.

Analytical Procedure: The supernatant from a settled sample is fed into an AutoAnalyzer system where it is mixed with carbon dioxide free air and acidified. The DIC is then measured colorimetrically by allowing the CO_2 produced to pass through a gas permeable membrane into a weakly buffered alkaline phenolphthalein solution. The decrease in absorbance of this colored solution is then measured.

Instrumentation: Basic AA-II AutoAnalyzer system, 15 cm gas dialysis module. The colorimeter is in the inverse mode; 50 mm flow cell; 550 nm; Std cal (Std dev) = 2.91(0.039).

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.3 to 40.0	0 - 0.4 Abs.	0.4	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	154	32.0	32.25	0.25	0.499
B	154	16.0	16.16	0.16	0.304
Long Term Blank:	154	-	0.12	-	0.109
A+B	154	48.0	48.41	0.41	0.743
A-B	154	16.0	16.10	0.10	0.358

A+B: calc. WL 0.715 CL 1.07 actual WL 0.80 CL 1.20

A-B: calc. WL 0.715 CL 1.07 actual WL 0.80 CL 1.20

Std. Dev.: within, S_w = 0.253 between, S = 0.412 S/S_w = 1.63

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R1	-	-	-	-	-
R2	-	-	-	-	-
Digested Blanks:-	-	-	-	-	-
R1 +R2	-	-	-	-	-
R1 -R2	-	-	-	-	-

R1 +R2 calc. WL - CL - actual WL - CL -

R1 -R2 calc. WL - CL - actual WL - CL -

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	197	67	99	363
Std. Dev.:	0.188	0.282	0.265	0.234
Mean:	2.05	15.0	25.8	10.9

% RSD: 0.88% Detection Criteria: 0.31

Test Name: CARBON - DISSOLVED ORGANIC **Lab.:** RL

Units: mg/L **Period:** from 03/01/80 to 30/12/80

Sample Type: Domestic Waters, Rivers, Lakes, some Sewage samples.

Sample Preparation: Sewage samples may undergo a clean-up step prior to analysis.

Analytical Procedure: The supernatant from a settled sample is introduced into an AutoAnalyzer system where it is acidified and flushed with N_2 (500 ml min^{-1}) to remove inorganic carbon. The sample is then oxidized by a UV digestor in an acid-persulphate medium. The DOC is then measured colorimetrically by allowing the CO_2 produced to pass through a gas permeable membrane into a weakly buffered alkaline phenolphthalein solution. The decrease in absorbance of this colored solution is then measured.

Instrumentation: Basic AA-II AutoAnalyzer system, UV digestor, 15 cm gas dialysis modules, N_2 cylinder, reducing valve and flow meter. The colorimeter is in the inverse mode; 50 mm flow cell; standard cal (std dev) = 5.06 (.059); 550 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.2 - 20.0	0 - 0.3 Abs.	0.2	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	154	12.0	12.16	0.16	0.383
B	154	6.0	6.08	0.08	0.180
Long Term Blank:	153	-	0.05	-	0.059
A+B	154	18.0	18.24	0.24	0.534
A-B	154	6.0	6.09	0.09	0.271

A+B: calc. WL 0.541 CL 0.812 actual WL 0.40 CL 0.60

A-B: calc. WL 0.541 CL 0.812 actual WL 0.40 CL 0.60

Std. Dev.: within, S_w = 0.191 between, S = 0.299 S/S_w = 1.57

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	-	-	-	-	-
R_2	-	-	-	-	-
Digested Blanks:-	-	-	-	-	-
R_1+R_2	-	-	-	-	-
R_1-R_2	-	-	-	-	-

R_1+R_2 calc. WL - CL - actual WL - CL -

R_1-R_2 calc. WL - CL - actual WL - CL -

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	187	185	31	403
Std. Dev.:	0.135	0.156	0.150	0.149
Mean:	2.37	6.18	13.12	4.88

% RSD: 1.00 Detection Criteria: 0.22

Test Name: CHEMICAL OXYGEN DEMAND

Lab.: RL

Units: mg/L as COD

Period: from 14/01/80 to 31/12/80

Sample Type: Rivers and Lakes

Sample Preparation:

Analytical Procedure: An aliquot of sample (10 ml) is refluxed for two hours with concentrated sulphuric acid, dichromate, mercuric sulphate and silver sulphate. The organic matter is oxidized and the digestate is back titrated with standardized ferrous ammonium sulphate using Ferroin indicator to determine the amount of dichromate used.

Instrumentation: Mini-digestion system.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
8 - 1000	-	10	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	55	-	189.2	-	10.23
B	55	-	92.9	-	9.07
Long Term Blank:					
A+B	54	-	282.0	-	18.56
A-B	54	-	96.2	-	5.92
A+B: calc. WL	11.8	CL 17.8	actual WL 13.0	CL 20.0	
A-B: calc. WL	11.8	CL 17.8	actual WL 13.0	CL 20.0	

Std. Dev.: within, S_w = 4.19 between, S = 9.74 S/S_w = 2.33

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	55	500	492.3	-	10.30
R_2	-	-	-	-	-
Digested Blanks:	56	-	10.93	-	12.63
$R_1 + R_2$	-	-	-	-	-
$R_1 - R_2$	-	-	-	-	-
$R_1 + R_2$ calc. WL	-	CL -	actual WL -	CL -	
$R_1 - R_2$ calc. WL	-	CL -	actual WL -	CL -	

Std. Dev.: within, S_w = - between, S = - S/S_w =

Range = < 1000

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:				
Std. Dev.:				
Mean:				
% RSD:		Detection Criteria:		

Range = 8 - 100

Number:	54	73	4	131
Std. Dev.:	4.56	4.60	3.42	4.56
Mean:	16.0	35.1	71.3	28.4
% RSD: 4.6%		Detection Criteria: 7.5		

Test Name: CHLOROPHYLL a

Lab.: RL

Units: µg/L

Period: from 11/01/80 to 25/11/80

Sample Type: Rivers and Lakes

Sample Preparation: Samples are preserved with 1 ml of a 0.5% (W/V) magnesium carbonate solution. Samples should be filtered in the field.

Analytical Procedure: An aliquot of known volume is filtered through a 1.2 µ cellulose nitrate membrane filter. The filters are extracted with 90% acetone following grinding with glass beads. After filtration or centrifuging, the absorbances of the extract at 750, 665, 645 and 630 nm are measured using a spectrophotometer. The chlorophyll results are calculated using the SCOR-UNESCO equations. Chlorophyll b is measured at the same time. Acidified chlorophyll a is measured on the same aliquot after acidifying with 1 drop of 10% HCl.

Instrumentation: Unicam SP 1700 UV spectrophotometer. Band width = 0.8 nm; slit width 0.26 mm; 40 mm cell; Digitizer, HP 9825A computer system.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<10	0 - 0.2 Abs.	0.1	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	178	-	7.61	-	0.355
B	176	-	2.28	-	0.156
Long Term Blank:	-	-	-	-	-
A+B	176	-	9.90	-	0.466
A-B	176	-	5.33	-	0.274
A+B: calc. WL	0.547	CL 0.821	actual WL -	CL -	
A-B: calc. WL	0.547	CL 0.821	actual WL -	CL -	

Std. Dev.: within, S_w = .193 between, S = 0.270 S/S_w = 1.40

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R 1	-	-	-	-	-
R 2	-	-	-	-	-
Digested Blanks:	-	-	-	-	-
R 1+R 2	-	-	-	-	-
R 1-R 2	-	-	-	-	-
R 1+R 2 calc. WL	-	CL -	actual WL -	CL -	
R 1-R 2 calc. WL	-	CL -	actual WL -	CL -	

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	-	-	-	-
Std. Dev.:	-	-	-	-
Mean:	-	-	-	-

% RSD: - Detection Criteria: -

Test Name: CHLOROPHYLL b

Lab.: RL

Units: µg/L

Period: from 11/01/80 to 25/11/80

Sample Type: Rivers and Lakes

Sample Preparation: Samples are preserved with 1 mL of a 0.5% (W/V) magnesium carbonate solution. Samples should be filtered in the field.

Analytical Procedure: An aliquot of known volume is filtered through a 1.2 µ cellulose nitrate membrane filter. The filters are extracted with 90% acetone following grinding with glass beads. After filtering or centrifuging, the absorbances of the extract at 750, 665, 645 and 630 nm are measured with a spectrophotometer. The chlorophyll results are calculated using the SCOR-UNESCO equations. Chlorophyll a is measured at the same time.

Instrumentation: Unicam SP 1700 UV spectrophotometer. Band width = 0.8 nm; slit width = 0.26 mm; 40 mm cell; Digitizer, HP 9825A computer system.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<10	0 - 0.2 Abs.	0.1	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	168	-	4.97	-	0.976
B	168	-	1.22	-	0.401
Long Term Blank:	-	-	-	-	-
A+B	168	-	6.19	-	1.307
A-B	168	-	3.75	-	0.721
A+B: calc. WL	1.44	CL 2.16	actual WL -	CL -	
A-B: calc. WL	1.44	CL 2.16	actual WL -	CL -	

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	-	-	-	-	-
R_2	-	-	-	-	-
Digested Blanks:	-	-	-	-	-
R_1+R_2	-	-	-	-	-
R_1-R_2	-	-	-	-	-
R_1+R_2 calc. WL	-	CL -	actual WL -	CL -	
R_1-R_2 calc. WL	-	CL -	actual WL -	CL -	

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	-	-	-	-
Std. Dev.:	-	-	-	-
Mean:	-	-	-	-

% RSD: - Detection Criteria: -

Test Name: COLOR - APPARENT

Lab.: RL

Units: Hazen Units

Period: from 02/04/80 to 22/12/80

Sample Type: Rivers, Lakes

Sample Preparation: When the color exceeds the calibrated range, the sample is centrifuged and the test is repeated on the supernatant or its dilution. These results are reported as true color.

Analytical Procedure: For each sample, two absorbance values are measured with 2 colorimeters at different wavelengths. The absorbance value for the longer wavelength range is used to estimate the particulate contribution to apparent color. The apparent color is calculated from the two absorbance values using an empirically derived equation.

Instrumentation: Two Klett Summerson colorimeters, one with broadband filter #42 (400-450 nm) and the other with filter #69 (660-740 nm); 4 cm cell path length.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
1 - 70	-	1	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	11	-	42.18	-	1.779
B	11	-	9.10	-	1.202
Long Term Blank:					
A+B	11	-	51.28	-	2.170
A-B	11	-	33.08	-	2.123

A+B: calc. WL 4.25 CL 6.37 actual WL - CL -

A-B: calc. WL 4.25 CL 6.37 actual WL - CL -

Std. Dev.: within, S_w = 1.501 between, S = 1.518 S/S_w = 1.01

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	-	-	-	-	-
R_2	-	-	-	-	-
Digested Blanks:	-	-	-	-	-
R_1+R_2	-	-	-	-	-
R_1-R_2	-	-	-	-	-

R_1+R_2 calc. WL - CL - actual WL - CL -

R_1-R_2 calc. WL - CL - actual WL - CL -

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	32	46	22	100
Std. Dev.:	0.602	1.02	1.16	0.962
Mean:	7.11	24.5	44.2	23.3

% RSD: 2.2% Detection Criteria: 0.99

Test Name: CONDUCTIVITY

Units: $\mu S/cm^{-1}$

Lab.: RL

Period: from 26/02/80 to 19/12/80

Sample Type: Rivers and Lakes

Sample Preparation:

Analytical Procedure: The sample aliquot is introduced into a jacketed conductivity cell and equilibrated to 25^0C.

Instrumentation: Radiometer CDM3 Conductivity meter with 324 jacketed conductivity cell. Manual reading and recording.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<1500	1500	20	0
<500	500	5	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	200	-	342.2	-	3.45
B	200	-	179.9	-	1.92
Long Term Blank:					
A+B	200	-	522.2	-	5.08
A-B	200	-	162.3	-	2.32
A+B: calc. WL	4.65	CL 6.97	actual WL 5.0	CL 7.5	
A-B: calc. WL	4.65	CL 6.97	actual WL 5.0	CL 7.5	
Std. Dev.: within, S_w= 1.64		between, S = 2.79	S/S_w = 1.70		
C	201	-	716.95	-	3.564
D	198	-	149.13	-	1.163
C+D	198	-	866.06	-	4.366
C-D	198	-	567.80	-	3.043
C+D calc. WL	6.08	CL 9.12	actual WL -	CL -	
C-D calc. WL	6.08	CL 9.12	actual WL -	CL -	
Std. Dev.: within, S_w= 2.152		between, S = 2.661	S/S_w = 1.24		

Range <2500

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	218	114	9	341
Std. Dev.:	1.62	2.28	0.0	1.85
Mean:	362	713	1606	512
% RSD: -		Detection Criteria: -		

Range <500

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	110	76	81	267
Std. Dev.:	0.469	1.394	1.508	1.167
Mean:	34.6	87.6	196	98.8
% RSD: 0.8%		Detection Criteria: -		

Test Name: pH

Lab.: RL

Units: pH units

Period: from 02/01/80 to 23/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: The pH is measured directly on a stirred aliquot of sample at room temperature using a pH meter.

Instrumentation: Radiometer pH M26 meter, glass and calomel electrodes.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
4.0 - 14	0 - 14 units	0.01	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	213	8.00	8.006	0.006	0.0249
B	214	6.86	6.871	0.011	0.0199
Long Term Blank:					
A+B	213	14.86	14.876	0.016	0.0394
A-B	213	1.14	1.136	-0.004	0.0220

A+B: calc. WL 0.044 CL 0.066 actual WL 0.100 CL 0.150

A-B: calc. WL 0.044 CL 0.066 actual WL 0.100 CL 0.150

Std. Dev.: within, S_w = 0.0156 between, S = 0.0225 S/S_w = 1.45

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R^1	-	-	-	-	-
R^2	-	-	-	-	-
Digested Blanks:	-	-	-	-	-
R^1+R^2	-	-	-	-	-
R^1-R^2	-	-	-	-	-

R^1+R^2 calc. WL - CL - actual WL - CL -

R^1-R^2 calc. WL - CL - actual WL - CL -

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	64	338	402
Std. Dev.:	-	0.066	0.033	0.040
Mean:	-	6.29	7.93	7.66

% RSD: 0.3% **Detection Criteria:** -

Test Name: PHENOLICS

Lab.: RL

Units: µg/L as phenol

Period: from 04/01/80 to 23/12/80

Sample Type: Rivers, Lakes, Domestic Waters, Sewage, Domestic Waste

Sample Preparation: Samples are preserved with copper sulphate and phosphoric acid. Samples may undergo solvent extraction or distillation prior to analysis.

Analytical Procedure: Samples are automatically distilled from an acid media via the AutoAnalyzer system. Phenolic compounds in the distillate are then buffered and reacted with 4-aminoantipyrene and potassium ferricyanide. The absorbance is then measured in a continuous flow system.

Instrumentation: AA-II AutoAnalyzer system plus a distillation unit. Std cal = 8.75; flow cell 50 mm, 505 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.6 - 50.0	0 - .015 Abs.	0.5	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	149	25.00	24.892	-0.108	0.5390
B	147	10.00	9.927	-0.073	0.3415
Long Term Blank:	148	-	0.204	-	0.8724
A+B	147	35.00	34.813	-0.187	0.8258
A-B	147	15.00	14.959	-0.041	0.3605

A+B: calc. WL 0.72 CL 1.08 actual WL 1.00 CL 1.50

A-B: calc. WL 0.72 CL 1.08 actual WL 1.00 CL 1.50

Std. Dev.: within, S_w = 0.2549 between, S = 0.4505 S/S_w = 1.77

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	-	-	-	-	-
R_2	-	-	-	-	-
Digested Blanks:	-	-	-	-	-
R_1+R_2	-	-	-	-	-
R_1-R_2	-	-	-	-	-

R_1+R_2 calc. WL - CL - actual WL - CL -

R_1-R_2 calc. WL - CL - actual WL - CL -

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	357	18	5	380
Std. Dev.:	0.356	0.382	1.05	0.382
Mean:	1.04	14.2	37.9	2.15

% RSD: 2.8%

Detection Criteria: 0.59

Test Name: TURBIDITY

Lab.: RL

Units: Formazin Turbidity Units

Period: from 28/01/80 to 20/12/80

Sample Type: Rivers, Lakes

Sample Preparation:

Analytical Procedure: The turbidity of a sample aliquot is compared with the turbidity of sealed standards which are prepared from latex polymers of known size and rated in Formazin Turbidity units.

Instrumentation: Hach Model 2100A Turbidimeter; stirrer not operated.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.2 to 20.0	-	0.2	1
20.0 to 200	-	2.0	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	-	-	-	-	-
B	-	-	-	-	-
Long Term Blank:	-	-	-	-	-
A+B	-	-	-	-	-
A-B	-	-	-	-	-

A+B: calc. WL - CL - actual WL - CL -

A-B: calc. WL - CL - actual WL - CL -

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R^1	-	-	-	-	-
R^2	-	-	-	-	-
Digested Blanks:	-	-	-	-	-
R^1+R^2	-	-	-	-	-
R^1-R^2	-	-	-	-	-

R^1+R^2 calc. WL - CL - actual WL - CL -

R^1-R^2 calc. WL - CL - actual WL - CL -

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Range: 20.0 - 200

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	16	11	3	30
Std. Dev.:	0.500	1.04	0.00	0.780
Mean:	31.2	60.6	153	54.2
% RSD: -		Detection Criteria: -		

Range 0.2 to 20.0

Number:	254	38	8	300
Std. Dev.:	0.105	0.185	0.707	0.199
Mean:	1.79	6.12	14.0	2.67
% RSD: 4.7%		Detection Criteria: 0.172		

SEWAGE AND INDUSTRIAL WASTE

LABORATORY

(BOD LAB.)

Test Name: BOD_5

Units: mg/L as BOD

Lab.: SIW

Period: from 21/07/80 to 15/10/80

Sample Type: Sewage, Industrial Waste

Sample Preparation: As required, the pH is adjusted to neutral and chlorine is removed by reaction with sodium sulphite. If required, the sample may be treated with allyl thiourea to suppress the nitrogenous oxygen demand.

Analytical Procedure: Sample concentrations are prepared by dilution with a nutrient enriched, buffered solution. The oxygen depletion over a five day period is determined on these dilutions which are stored in the dark at 20°C. The degree of dilution is chosen such that the oxygen depletion under the test conditions is roughly 50%. Samples are seeded with sewage as required. The oxygen meter is checked against the Winkler titration.

Instrumentation: Weston and Stack Oxygen analyzer; 0.5 mil thick Teflon membrane. Titration apparatus.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<500	-	0.05	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	31	217	177.9	-39.1	13.67
B	31	327	271.8	-55.2	19.11
Long Term Blank:	29	-	0.117	-	0.22
A+B	29	544	450.7	-93.3	31.89
A-B	29	-90	-94.0	4.0	9.88
A+B: calc. WL	19.8	CL 29.6	actual WL 20.0	CL 30.0	
A-B: calc. WL	19.8	CL 29.6	actual WL 20.0	CL 30.0	

Std. Dev.: within, S_w = 6.99 between, S = 16.69 S/S_w = 2.39

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
BOD Water Blanks:	34	-	0.3035	-	0.1799
R_1+R_2					
R_1-R_2					
R_1+R_2 calc. WL		CL	actual WL	CL	
R_1-R_2 calc. WL		CL	actual WL	CL	

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	93	57	7	157
Std. Dev.:	3.23	14.4	12.3	11.4
Mean:	38.3	162	34.0	96.9
% RSD: 3.27%		Detection Criteria: 5.3		

Test Name: CHEMICAL OXYGEN DEMAND

Lab.: SIW

Units: mg/L as COD

Period: from 30/04/80 to 30/10/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: Samples are mixed with concentrated sulphuric acid, dichromate, mercuric sulphate and silver sulphate and then refluxed for two hours. The digestate is back titrated with ferrous ammonium sulphate using Ferroin indicator, to determine the amount of dichromate consumed.

Instrumentation: Mini-digestion system.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
8 - 5000	-	10	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	32	1000	996.9	-3.1	6.44
B	32	500	501.3	1.3	7.93
Long Term Blank:	35	-	4.56	-	0.36
A+B	32	1500	1498.1	-1.9	12.81
A-B	32	500	495.6	-4.4	6.69
A+B: calc. WL	13.4	CL 20.1	actual WL 20.0	CL 30.0	
A-B: calc. WL	13.4	CL 20.1	actual WL 20.0	CL 30.0	

Std. Dev.: within, S_w = 4.73 between, S = 7.23 S/S_w = 1.53

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R1					
R2					
Digested Blanks:	34	-	4.54	-	0.34
R1+R2					
R1-R2					
R1+R2 calc. WL		CL	actual WL	CL	
R1-R2 calc. WL		CL	actual WL	CL	

Std. Dev.: within, S_w= between, S = S/S_w =

500 - 5000

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	5	1	0	6
Std. Dev.:	28.8	-	-	34.4
Mean:	705	1500	-	837
% RSD: -		Detection Criteria: -		

8 - 500

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	77	25	27	129
Std. Dev.:	5.90	24.3	18.3	14.9
Mean:	43.8	176	390	142
% RSD: 4.9%		Detection Criteria: 9.7		

Test Name: CONDUCTIVITY

Lab.: SIW

Units: µS/cm

Period: from 06/10/80 to 30/12/80

Sample Type: Sewage and Industrial Waste

Sample Preparation:

Analytical Procedure: The sample is introduced into a jacketed conductivity cell and equilibrated to 25°C. The result is manually recorded.

Instrumentation: Radiometer CDM3 meter and 324 jacketed conductivity cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<2500*	1500	20	3
	5000	50	3

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	36	1413	1411.9	-1.1	3.49
B	36	717.8	719.1	+1.3	1.99
Long Term Blank:	34	-	0.9		0.17
A+B	36	2130.8	2130.9	+0.1	3.73
A-B	36	695.2	692.8	-2.5	4.29

A+B: calc. WL 8.58 CL 12.9 actual WL 10.0 CL 15.0

A-B: calc. WL 8.58 CL 12.9 actual WL 10.0 CL 15.0

Std. Dev.: within, S_w = 3.03 between, S = 2.84 S/S_w = 0.94

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R1					
R2					
Digested Blanks:					
R1+R2					
R1-R2					

R1+R2 calc. WL CL actual WL CL

R1-R2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Range: <2500

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	3	29	7	39
Std. Dev.:	2.65	9.65	14.4	11.0
Mean:	411	813	1850	969

% RSD: 0.96%

Detection Criteria: -

Test Name: pH

Units: pH units

Lab.: SIW

Period: from 01/10/80 to 30/12/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: pH is measured directly on a stirred aliquot of sample at room temperature.

Instrumentation: Fisher Accumet pH meter, Model 320.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
7 - 9	0 - 14	0.1	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	28	9.0	8.989	0.011	0.033
B	28	4.0	4.020	0.020	0.027
Long Term Blank:					
A+B	28	13.0	13.009	0.009	0.020
A-B	28	5.0	4.969	-0.031	0.055

A+B: calc. WL 0.11 CL 0.16 actual WL 0.1 CL 0.2

A-B: calc. WL 0.11 CL 0.16 actual WL 0.1 CL 0.2

Std. Dev.: within, S_w = 0.04 between, S = 0.03 S/S_w = 0.77

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	5	20	25
Std. Dev.:	-	0.01	0.01	0.01
Mean:	-	5.92	7.68	7.33
% RSD: -		Detection Criteria: -		

Test Name: MBAS

Units: mg/L as LAS

Lab.: SIW

Period: from 02/10/80 to 30/12/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: Samples ($\leq$ 100 ml) are mixed with methylene blue which reacts with several types of alkyl sulphates in anionic surfactants to produce a blue colored quaternary salt. The latter is extracted into chloroform and the color is measured at 652 nm. The calibration standard is a linear alkyl sulphate (LAS) concentrate which is prepared by the U.S. E.P.A.

Instrumentation: Separatory funnels, Bausch and Lomb Spectronic 21, 2.2 mm diameter cuvettes.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.2 to 20	0 - 0.5 Abs.	0.01	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	20	6.0	5.8	-0.2	0.19
B	20	3.0	3.0	-0.00	0.10
Long Term Blank:	20	-	0.011	-	0.003
A+B	20	9.0	8.8	-0.2	0.20
A-B	20	3.0	2.8	-0.2	0.23

A+B: calc. WL 0.47 CL 0.70 actual WL 0.5 CL 0.8

A-B: calc. WL 0.47 CL 0.70 actual WL 0.5 CL 0.8

Std. Dev.: within, S_w = 0.17 between, S = 0.15 S/S_w = 0.92

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	12	7	0	19
Std. Dev.:	0.12	0.11	-	0.13
Mean:	1.70	2.8	-	3.37
% RSD:	-			

Detection Criteria: 0.20

Test Name: VOLATILE ACIDS

Lab.: SIW

Units: mg/L as acetic acid

Period: from 15/01/80 to 01/12/80

Sample Type: Sewage, Industrial Waste

Sample Preparation: Samples are centrifuged and the test is performed on the supernatant.

Analytical Procedure: An acidified aqueous sample containing short chain organic acids is adsorbed on a column; these are eluted with chloroform-butanol solvent. The eluate is collected and titrated with standard 0.02N sodium hydroxide to the phenolphthalein endpoint. The exact normality of the titrant is determined by titrating against a 0.02N potassium biphthalate solution to the phenolphthalein endpoint.

Instrumentation: Silicic acid (50 - 200 mesh) is the chromatographic separatory medium; fritted glass crucibles; buret, vacuum.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
16 to 3000	-	12	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	48	1025*	1088	+63	74.59
B	-	-	-	-	-
Long Term Blank:	47	-	679	-	47
A+B	-	-	-	-	-
A-B	-	-	-	-	-

A+B: calc. WL CL actual WL CL

A-B: calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	25	15	3	44
Std. Dev.:	9.97	13.3	1.73	10.6
Mean:	411	896	1740	667

% RSD: 0.08% Detection Criteria: 16.4

SEWAGE AND INDUSTRIAL WASTE

LABORATORY

(NUTRIENT LABORATORY)

Test Name: DISTILLED AMMONIA

Lab.: SIW

Units: mg/L as N

Period: from 15/01/80 to 16/12/80

Sample Type: Sludges

Sample Preparation: Sludges are centrifuged. Analysis is performed on the supernatant.

Analytical Procedure: The supernatant of samples is automatically distilled in an AutoAnalyzer system. Ammonia is determined on the distillate by formation of indophenol blue in a buffered media using nitroprusside as a catalyst.

Instrumentation: Basic AA-II AutoAnalyzer system plus distillation unit, gas-liquid separator, heating bath module (7.7 ml delay coil at 38 °C). Std Cal (Std dev) = 1.55 (0.272); 630 nm; 1.5 cm flow cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
50 - 1000	0 - 0.5 Abs.*	10	1

* 1.5 cm flow cell

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	31	700	699.0	-1.0	8.21
B	31	140	143.9	3.9	4.42
Long Term Blank:					
A+B	31	840	842.9	2.9	10.63
A-B	31	560	555.2	-4.8	7.80
A+B: calc. WL	15.6	CL 23.4	actual WL 20.0	CL 30.0	
A-B: calc. WL	15.6	CL 23.4	actual WL 20.0	CL 30.0	

Std. Dev.: within, S_w = 5.51 between, S = 6.59 S/S_w = 1.20

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					
R_1+R_2 calc. WL		CL	actual WL	CL	
R_1-R_2 calc. WL		CL	actual WL	CL	

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	19	10	24	53
Std. Dev.:	4.52	4.97	5.71	5.66
Mean:	94.7	318	755	436

% RSD: 0.76% Detection Criteria: 7.4

Test Name: AMMONIA PLUS AMMONIUM - HIGH RANGE **Lab.:** SIW

Units: mg/L as N **Period:** from 07/10/80 to 31/12/80

Sample Type: Sewage, Industrial Waste, Sludge

Sample Preparation: as per Low Range

Analytical Procedure: as per Low Range

Instrumentation: as per Low Range but with a 2.5x scale expansion.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
20.0 - 50.0	0 - 0.7 *	0.5	2

* 1.5 cm flow cell

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	29	35.5	35.26	-0.24	0.356
B	29	14.0	14.03	0.03	0.088
Long Term Blank:					
A+B	27	49.5	49.31	-0.19	0.392
A-B	27	21.5	21.25	-0.25	0.353

A+B: calc. WL 0.70 CL 1.06 actual WL 1.00 CL 1.50

A-B: calc. WL 0.70 CL 1.06 actual WL 1.00 CL 1.50

Std. Dev.: within, S_w= 0.250 between, S = 0.264 S/S_w = 1.06

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	5	8	13
Std. Dev.:	-	0.477	0.267	0.371
Mean:	-	23.5	35.9	31.1

% RSD: 0.7% Detection Criteria: -

Test Name: AMMONIA PLUS AMMONIUM - LOW RANGE **Lab.:** SIW

Units: mg/L as N **Period:** from 02/10/80 to 31/12/80

Sample Type: Sewage, Industrial Waste, Sludges

Sample Preparation: Sludges are centrifuged, and analysis is performed on the supernatant. Other samples are filtered automatically using S and S filter rolls.

Analytical Procedure: Via an AA-II system, ammonia is determined by formation of indophenol blue in a buffered alkaline system using nitroprusside as a catalyst.

Instrumentation: Basic AA-II AutoAnalyzer system plus a Heating Bath Module (7.7 ml delay coil at 38 ^{0}C). Continuous filter module. Std Cal (Std dev) = 5.40 (0.287); 15 mm flow cell; 630 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
02. to 20.0	0 - 0.3*	0.2	1

* 1.5 cm flow cell

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	29	14.0	14.06	0.06	0.108
D	29	3.5	3.39	-0.11	0.062
Long Term Blank:					
C+D	27	17.5	17.45	-0.05	0.160
C-D	27	10.5	10.67	0.17	0.086

C+D: calc. WL 0.17 CL 0.26 actual WL 0.40 CL 0.60

C-D: calc. WL 0.17 CL 0.26 actual WL 0.40 CL 0.60

Std. Dev.: within, S_w= 0.061 between, S = 0.091 S/S_w = 1.50

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	28	1	18	47
Std. Dev.:	0.103	-	0.194	0.152
Mean:	0.655	7.90	15.2	6.37

% RSD: 1.29% Detection Criteria: 0.17

Test Name: NITROGEN - TOTAL KJELDAHL

Units: mg/L as N

Lab.: SIW

Period: from 02/10/80 to 30/12/80

Sample Type: Sewage, Industrial Waste, Sludges

Sample Preparation:

Analytical Procedure: Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using two block digesters maintained at 200 C and 360 C. Via an AA-II system, the pH of the digestate is adjusted and the ammonia content is determined by formation of indophenol blue in a buffered alkaline system using nitroprusside as a catalyst.

Instrumentation: Basic AA-II system plus two Technicon DB-40 block digesters; heating bath module (7.7 ml delay coil at 38 C). Std Cal (Std dev) = 1.438 (0.2895); 630 nm; 50 mm flow cell.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.2 to 10.0	0 - 0.83 Abs.	0.1	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	40	7.0	7.03	0.03	0.072
B	40	1.4	1.43	0.03	0.044
Long Term Blank:					
A+B	36	8.4	8.46	0.06	0.084
A-B	36	5.6	5.61	0.01	0.084

A+B: calc. WL 0.17 CL 0.25 actual WL 0.20 CL 0.30

A-B: calc. WL 0.17 CL 0.25 actual WL 0.20 CL 0.30

Std. Dev.: within, S_w = 0.059 between, S = 0.059 S/S_w = 1.00

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R 1	71	7.0	6.96	-0.04	0.130
R 2	71	3.5	3.49	-0.01	0.087
Digested Blanks:					
R 1+R 2	36	10.5	10.51	0.01	0.196
R 1-R 2	36	3.5	3.47	-0.03	0.115

R 1+R 2 calc. WL 0.23 CL 0.34 actual WL - CL -

R 1-R 2 calc. WL 0.23 CL 0.34 actual WL - CL -

Std. Dev.: within, S_w = 0.081 between, S = 0.113 S/S_w = 1.40

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	18	45	16	79
Std. Dev.:	0.102	0.146	0.159	0.143
Mean:	1.53	3.54	6.22	3.63

% RSD: 2.1%

Detection Criteria: 0.17

Test Name: NITRATE PLUS NITRITE - HIGH RANGE

Lab.: SIW

Units: mg/L as N

Period: from 02/10/80 to 13/12/80

Sample Type: Sewage, Industrial Waste, Sludges

Sample Preparation: as per Low Range

Analytical Procedure: as per Low Range

Instrumentation: as per Low Range but with a 2.5x scale expansion.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
20.0 to 50.0	0 - 0.7 Abs.	0.5	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	36	35.0	35.22	0.22	0.252
B	36	15.4	15.13	-0.27	0.219
Long Term Blank:					
A+B	29	50.4	50.39	-0.01	0.410
A-B	29	19.6	20.10	0.50	0.251

A+B: calc. WL 0.50 CL 0.75 actual WL 1.00 CL 1.50

A-B: calc. WL 0.50 CL 0.75 actual WL 1.00 CL 1.50

Std. Dev.: within, S_w = 0.178 between, S = 0.2111 S/S_w = 1.35

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	5	0	5
Std. Dev.:	-	0.000	-	0.000
Mean:	-	21.9	-	21.9
% RSD: -		Detection Criteria: -		

Test Name: NITRATE PLUS NITRITE - LOW RANGE **Lab.:** SIW

Units: mg/L as N **Period:** from 02/10/80 to 31/12/80

Sample Type: Sewage, Industrial Waste, Sludges

Sample Preparation: Sludges are centrifuged. Analysis is performed on the supernatant. Samples are filtered automatically using S and S glass fibre filter rolls.

Analytical Procedure: In an AA-II system, nitrate is reduced to nitrite by hydrazine sulphate in alkaline media using copper as a catalyst. The nitrate plus nitrite content is determined by formation of an azo dye using sulphanilamide and N(1-naphthyl) ethylenediamine dihydrochloride. To control metal ion interferences, samples are passed through an Amberlite IR-120(H) ion exchange column prior to the reduction step.

Instrumentation: Basic AA-II AutoAnalyzer system plus heating bath (7.7 ml delay coil at 38 °C). Two pen recorder and an ion exchange column. Std Cal (Std dev) = 1.95 (0.15); 50 mm flow cell; 520 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.1 to 20.0	0 - 0.3 Abs.	0.2	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	36	15.4	15.30	-0.10	0.146
D	36	4.2	4.06	-0.14	0.084
Long Term Blank:					
C+D	29	19.6	19.36	-0.24	0.216
C-D	29	11.2	11.24	+0.04	0.133

C+D: calc. WL 0.27 CL 0.40 actual WL 0.40 CL 0.60

C-D: calc. WL 0.27 CL 0.40 actual WL 0.40 CL 0.60

Std. Dev.: within, S_w = 0.094 between, S = 0.127 S/S_w = 1.35

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	27	26	18	71
Std. Dev.:	0.075	0.099	0.086	0.088
Mean:	1.09	7.30	15.2	6.94

% RSD: 0.57% **Detection Criteria:** 0.12

Test Name: NITRITE

Units: mg/L as N

Lab.: SIW

Period: from 02/10/80 to 31/12/80

Sample Type: Sewage, Industrial Waste, Sludges

Sample Preparation: Sludges are centrifuged. Analysis is performed on the supernatant. Samples are filtered automatically using S and S glass fibre filter rolls.

Analytical Procedure: Via an AA-II system, nitrite is determined by formation of an azo dye using sulphanilamide and N(1-naphthyl) ethylenediamine dihydrochloride.

Instrumentation: Basic AA-II AutoAnalyzer system plus automated filtration unit. Std Cal(Std dev) = 4.58 (0.3361); 50 mm flow cell; 520 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.02 to 2.00	0 - 0.35 Abs.	0.02	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	37	1.40	1.399	-0.001	0.0259
D	37	0.70	0.688	-0.012	0.0237
Long Term Blank:					
C+D	29	2.10	2.104	0.004	0.0334
C-D	29	0.70	0.712	0.012	0.0174

C+D: calc. WL 0.035 CL 0.052 actual WL 0.040 CL 0.060

C-D: calc. WL 0.035 CL 0.052 actual WL 0.040 CL 0.060

Std. Dev.: within, S_w = 0.0123 between, S = 0.0188 S/S_w = 1.53

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	57	12	7	76
Std. Dev.:	0.0080	0.0079	0.0383	0.0147
Mean:	0.0861	0.6713	1.4343	0.3027

% RSD: 2.5%

Detection Criteria: 0.013

Test Name: PHOSPHORUS, FILTERED - HIGH RANGE **Lab.:** SIW

Units: mg/L as P **Period:** from 02/10/80 to 31/12/80

Sample Type: Sewage, Industrial Waste, Sludges

Sample Preparation: as per Low Range

Analytical Procedure: as per Low Range

Instrumentation: as per Low Range but with a 2.5x scale expansion.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
4.00 - 10.0	0 - 0.7 Abs.	0.1	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	29	7.0	7.03	0.03	0.065
B	29	3.5	3.51	0.01	0.035
Long Term Blank:					
A+B	27	10.5	10.55	0.05	0.086
A-B	27	3.5	3.53	0.03	0.054

A+B: calc. WL 0.11 CL 0.16 actual WL 0.20 CL 0.30

A-B: calc. WL 0.11 CL 0.16 actual WL 0.20 CL 0.30

Std. Dev.: within, S_w= 0.038 between, S = 0.051 S/S_w = 1.32

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	4	6	10
Std. Dev.:	-	0.141	0.075	0.107
Mean:	-	4.37	5.76	5.20

% RSD: 1.0% **Detection Criteria:** -

Test Name: PHOSPHORUS, FILTERED - LOW RANGE **Lab.:** SIW

Units: mg/L as P **Period:** from 02/10/80 to 31/12/80

Sample Type: Sewage, Industrial Waste, Sludge

Sample Preparation: Samples are filtered automatically using S and S filter rolls. Sludges are centrifuged, and analysis is performed on the supernatant.

Analytical Procedure: Orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex. Ascorbic acid is the reducing agent.

Instrumentation: Basic AA-II AutoAnalyzer system plus continuous filter module. Std Cal (Std. dev) = 1.37 (0.16); 50 mm flow cell; 880 nm; special phototubes.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.06 - 4.00	0 - 0.3 Abs.	0.04	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	29	3.50	3.517	0.017	0.0304
D	29	0.70	0.657	-0.043	0.0227
Long Term Blank:					
C+D	27	4.20	4.177	-0.023	0.0447
C-D	27	2.80	2.860	0.060	0.0789

C+D: calc. WL 0.06 CL 0.09 actual WL 0.08 CL 0.12

C-D: calc. WL 0.06 CL 0.09 actual WL 0.08 CL 0.12

Std. Dev.: within, S_w = 0.0204 between, S = 0.0266 S/S_w = 1.30

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	24	8	11	43
Std. Dev.:	0.0348	0.0684	0.0414	0.0493
Mean:	0.2058	1.559	2.833	1.130

% RSD: 1.38%

Detection Criteria: 0.057

Test Name: PHOSPHORUS - TOTAL

Units: mg/L as P

Lab.: SIW

Period: from 02/10/80 to 30/12/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using two block digesters maintained at 200°C and 360°C. Via an AA-II system, pH control is obtained, and the orthophosphate content in the digestate is determined by formation of a reduced phospho-antimonyl-molybdate complex. Ascorbic acid is the reducing agent.

Instrumentation: Basic AA-II AutoAnalyzer system plus two Technicon DB 40 block digesters. Std. Cal (Std Dev) = 4.57 (0.23); 50 mm flow cell; 880 nm; special phototubes.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.03 to 2.00	0 - 0.35 Abs.	0.02	1

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	39	1.40	1.406	0.006	0.0109
B	33	0.28	0.262	-0.018	0.0161
Long Term Blank:	-	-	< 0.01	-	-
A+B	31	1.68	1.670	-0.010	0.0187
A-B	31	1.12	1.145	0.025	0.0189
A+B: calc. WL	0.038	CL 0.057	actual WL 0.040	CL 0.060	
A-B: calc. WL	0.038	CL 0.057	actual WL 0.040	CL 0.060	

Std. Dev.: within, S_w = 0.0134 between, S = 0.0133 S/S_w = 0.99

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	66	1.40	1.375	-0.025	0.0337
R_2	66	0.70	0.651	-0.049	0.0389
Digested Blanks:	-	-	<0.01	-	-
R_1+R_2	35	2.10	1.012	-0.088	0.0817
R_1-R_2	35	0.70	0.727	0.027	0.0260
R_1+R_2 calc. WL	0.052	CL 0.078	actual WL -	CL -	
R_1-R_2 calc. WL	0.052	CL 0.078	actual WL -	CL -	

Std. Dev.: within, S_w = 0.0184 between, S = 0.0429 S/S_w = 2.33

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	23	45	8	76
Std. Dev.:	0.0201	0.0304	0.0573	0.0330
Mean:	0.2526	0.6846	1.468	0.6363

% RSD: 3.82%

Detection Criteria: 0.033

SEWAGE AND INDUSTRIAL WASTE LABORATORY

(SOLIDS LABORATORY)

Test Name: SUSPENDED SOLIDS - IGNITED
SUSPENDED SOLIDS - LOW RANGE

Lab.: SIW

Units:

Period: from 15/08/80
to 31/12/80

Sample Type: Sewage, Industrial Wastes

Sample Preparation:

Analytical Procedure: as per High Range

Instrumentation: as per High Range

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
Susp. <100	-	0.05*	0
Ignit. <100 Susp.	-	0.05*	0

* Based on a 200 ml sample aliquot and balance sensitivity.

Quality Control Data: Balance 1

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	93	-	0.500087	-	0.000037
B	93	-	0.050050	-	0.000040
Long Term Blank:					
A+B	93	-	0.550138	-	0.000071
A-B	93	-	0.450037	-	0.000031

A+B: calc. WL 0.00006 CL 0.00009 actual WL 0.0010 CL 0.0015
A-B: calc. WL 0.00006 CL 0.00009 actual WL 0.0010 CL 0.0015
Std. Dev.: within, S_w= 0.00002 between, S = 0.000035 S/S_w = 1.75

Quality Control Data: Balance 2

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	93	-	0.500064	-	0.000127
B	93	-	0.050097	-	0.000300
Long Term Blank:					
A+B	93	-	0.550162	-	0.000339
A-B	93	-	0.449967	-	0.000312

A+B: calc. WL 0.00062 CL 0.00093 actual WL 0.0010 CL 0.0015
A-B: calc. WL 0.00062 CL 0.00093 actual WL 0.0010 CL 0.0015
Std. Dev.: within, S_w= 0.00022 between, S = 0.00023 S/S_w = 1.04

Suspended

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	1	17	20	38
Std. Dev.:	-	3.71	4.24	3.89
Mean:	5.5	40.0	76.1	58.1
% RSD: 5.65%		Detection Criteria:	-	

Ignited

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	1	2	1	4
Std. Dev.:	-	0.71	-	4.62
Mean:	6.00	41.7	102	48.0
% RSD: -		Detection Criteria:	-	

Test Name: SUSPENDED SOLIDS - IGNITED
SUSPENDED SOLIDS - HIGH RANGE

Lab.: SIW

Units: mg/L

Period: from 15/08/80
to 31/12/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: Sample aliquots (25-500 mL) are filtered through preweighed Reeve Angel 934AH glass fibre filter papers. After drying at 103°C for 18 hours, the filters are reweighed. The suspended solids are calculated by difference.
Ignited Solids: The filters are ignited for one hour at 600°C, reweighed and then the ignited suspended solids are calculated by difference.

Instrumentation: 2 Mettler 5-place balances; calculator muffle furnace.

Quality Control Data: Balance 1

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	93	-	0.500087	-	0.000037
B	93	-	0.050050	-	0.000040
Long Term Blank:					
A+B	93	-	0.550138	-	0.000071
A-B	93	-	0.450037	-	0.000031

A+B: calc. WL 0.00006 CL 0.00009 actual WL 0.0010 CL 0.0015
A-B: calc. WL 0.00006 CL 0.00009 actual WL 0.0010 CL 0.0015
Std. Dev.: within, S_w = 0.00002 between, S = 0.000035 S/S_w = 1.75

Quality Control Data: Balance 2

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	93	-	0.500064	-	0.000127
B	93	-	0.050097	-	0.000300
Long Term Blank:					
A+B	93	-	0.550162	-	0.000339
A-B	93	-	0.449967	-	0.000312

A+B: calc. WL 0.00062 CL 0.00093 actual WL 0.0010 CL 0.0015
A-B: calc. WL 0.00062 CL 0.00093 actual WL 0.0010 CL 0.0015
Std. Dev.: within, S_w = 0.00022 between, S = 0.00023 S/S_w = 1.04

Suspended

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	88	16	27	131
Std. Dev.:	14.1	31.9	154	56.2
Mean:	230	946	2290	742
% RSD: 6.8%		Detection Criteria: -		

Ignited Susp.

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	8	18	8	34
Std. Dev.:	15.6	32.1	54.0	38.6
Mean:	356	984	1840	1040
% RSD:		Detection Criteria:		

Test Name: DISSOLVED SOLIDS - IGNITED
DISSOLVED SOLIDS - LOW RANGE

Lab.: SIW

Units: mg/L

Period: from 03/03/80 to 11/08/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: as per High Range

Instrumentation: as per High Range

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
Diss. < 2500	-	0.2*	0
Ignit. < 2500	-	0.2*	0

* Based on balance sensitivity and a 50 ml sample aliquot.

Quality Control Data: Balance 1

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	-	44.057173	-	0.000439
B	94	-	39.452501	-	0.000401
Long Term Blank:					
A+B	94	-	83.509678	-	0.000733
A-B	94	-	4.604676	-	0.000214

A+B: calc. WL	0.00042	CL	0.00064	actual WL	0.00100	CL	0.00150
A-B: calc. WL	0.00042	CL	0.00064	actual WL	0.00100	CL	0.00150

Std. Dev.: within, S_w = 0.00015 between, S = 0.00038 S/S_w = 2.52

Quality Control Data: Balance 2

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	-	45.057004	-	0.000486
B	94	-	39.452366	-	0.000639
Long Term Blank:					
A+B	94	-	83.509374	-	0.000967
A-B	94	-	4.604643	-	0.000562

A+B: calc. WL	0.00112	CL	0.00168	actual WL	0.00100	CL	0.00150
A-B: calc. WL	0.00112	CL	0.00168	actual WL	0.00100	CL	0.00150

Std. Dev.: within, S_w = 0.00039 between, S = 0.00055 S/S_w = 1.41

Dissolved

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	36	19	9	64
Std. Dev.:	7.03	39.9	17.2	25.5
Mean:	234	858	1770	636
% RSD: -		Detection Criteria:	1%	

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	2	3	4	9
Std. Dev.:	0.707	21.6	135	98.5
Mean:	13.8	790	1810	1070
% RSD:		Detection Criteria:		

Test Name: DISSOLVED SOLIDS - IGNITED
DISSOLVED SOLIDS - HIGH RANGE

Lab.: SIW

Units: mg/L

Period: from 03/03/80 to 11/08/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: Samples are filtered through Reev-Angel 934 AH glass fibre filters and then pipetted (50 mL) into preweighed crucibles. The crucibles are dried for 18 hours at 103° C and then reweighed after cooling in a desiccator. Dissolved solids are calculated by difference.

Ignited: the crucibles are ignited for 1 hour at 600° C and then reweighed after cooling in a desiccator. Ignited dissolved solids are determined by difference.

Instrumentation: 2 Mettler 5-place balances, muffle furnace Coors evaporating dishes.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
Diss. < 30,000	-	0.2*	0
Ignit. < 30,000	-	0.2*	0

* Based on a 50 ml sample aliquot and balance sensitivity.

Quality Control Data: Balance 1

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	-	44.057173	-	0.000439
B	94	-	39.452501	-	0.000401
Long Term Blank:					
A+B	94	-	83.509678	-	0.000733
A-B	94	-	4.604676	-	0.000214

A+B: calc. WL	0.00042	CL	0.00064	actual WL	0.00100	CL	0.00150
A-B: calc. WL	0.00042	CL	0.00064	actual WL	0.00100	CL	0.00150

Std. Dev.: within, S_w = 0.00015 between, S = 0.00038 S/S_w = 2.52

Quality Control Data: Balance 2

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	-	45.057004	-	0.000486
B	94	-	39.452366	-	0.000639
Long Term Blank:					
A+B	94	-	83.509374	-	0.000967
A-B	94	-	4.604643	-	0.000562

A+B: calc. WL	0.00112	CL	0.00168	actual WL	0.00100	CL	0.00150
A-B: calc. WL	0.00112	CL	0.00168	actual WL	0.00100	CL	0.00150

Std. Dev.: within, S_w = 0.00039 between, S = 0.00055 S/S_w = 1.41

Dissolved

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	4	13	5	22
Std. Dev.:	40.1	256	219	254
Mean:	3930	9520	21,230	11,170
% RSD: 1%		Detection Criteria:	-	

Ignited

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	0	1	0	1
Std. Dev.:	-	-	-	-
Mean:	-	10,000	-	10,000
% RSD:		Detection Criteria:		

Test Name: TOTAL SOLIDS & IGNITED
TOTAL SOLIDS - HIGH RANGE

Lab.: SIW

Units: mg/L

Period: from 03/03/80
to 11/08/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: Total Solids: Samples (50 mL) are dried in preweighed crucibles for 18 hours at 103° C. The crucibles are reweighed and total solids are determined by difference. Ignited Solids: The crucibles and samples are then ignited in a muffle furnace for one hour at 600° C. The crucibles are then reweighed and ignited total solids are determined by difference.

Instrumentation: Evaporating dishes, muffle furnace; 2 Mettler 5 place balances.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
Total < 30,000	-	0.2*	0
Ignit. < 30,000	-	0.2*	0

* Based on balance sensitivity and a 50 mL sample aliquot.

Quality Control Data: Balance 1

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	-	44.057173	-	0.000439
B	94	-	39.452501	-	0.000401
Long Term Blank:					
A+B	94	-	83.509678	-	0.000733
A-B	94	-	4.604676	-	0.000214

A+B: calc. WL	0.00042	CL	0.00064	actual WL	0.00100	CL	0.00150
A-B: calc. WL	0.00042	CL	0.00064	actual WL	0.00100	CL	0.00150

Std. Dev.: within, S_w = 0.00015 between, S = 0.00038 S/S_w = 2.52

Quality Control Data: Balance 2

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	-	45.057004	-	0.000486
B	94	-	39.452366	-	0.000639
Long Term Blank:					
A+B	94	-	83.509374	-	0.000967
A-B	94	-	4.604643	-	0.000562

A+B: calc. WL	0.00112	CL	0.00168	actual WL	0.00100	CL	0.00150
A-B: calc. WL	0.00112	CL	0.00168	actual WL	0.00100	CL	0.00150

Std. Dev.: within, S_w = 0.00039 between, S = 0.00055 S/S_w = 1.41

Totals

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	5	4	1	10
Std. Dev.:	179	415	-	338
Mean:	4480	10,300	17,300	8100
% RSD: -		Detection Criteria: -		

Ignited

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	15	37	9	61
Std. Dev.:	87.7	308	479	330
Mean:	3410	9590	18,000	9440
% RSD: 2.1%		Detection Criteria: -		

Test Name: TOTAL SOLIDS - IGNITED TOTAL SOLIDS LOW RANGE

Lab.: SIW

Units: mg/L

Period: from 02/07/80 to 11/08/80

Sample Type: Sewage, Industrial Waste

Sample Preparation:

Analytical Procedure: As per High Range

Instrumentation: As per High Range

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
Total < 2500	-	0.2*	0
Ignit. < 2500	-	0.2*	0

* Based on balance sensitivity and a 50 mL sample aliquot.

Quality Control Data: Balance 1

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	-	44.057173	-	0.000439
B	94	-	39.452501	-	0.000401
Long Term Blank:					
A+B	94	-	83.509678	-	0.000733
A-B	94	-	4.604676	-	0.000214

A+B: calc. WL	0.00042	CL	0.00064	actual WL	0.00100	CL	0.00150
A-B: calc. WL	0.00042	CL	0.00064	actual WL	0.00100	CL	0.00150

Std. Dev.: within, S_w = 0.00015 between, S = 0.00038 S/S_w = 2.52

Quality Control Data: Balance 2

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	94	-	45.057004	-	0.000486
B	94	-	39.452366	-	0.000639
Long Term Blank:					
A+B	94	-	83.509374	-	0.000967
A-B	94	-	4.604643	-	0.000562

A+B: calc. WL	0.00112	CL	0.00168	actual WL	0.00100	CL	0.00150
A-B: calc. WL	0.00112	CL	0.00168	actual WL	0.00100	CL	0.00150

Std. Dev.: within, S_w = 0.00039 between, S = 0.00055 S/S_w = 1.41

Totals

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	4	7	4	15
Std. Dev.:	5.23	14.3	27.0	26.7
Mean:	255	809	1520	851
% RSD: 1.44%		Detection Criteria:	-	

Ignited

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	2	6	13	21
Std. Dev.:	0.000	4.28	67.1	59.6
Mean:	271	941	1940	1490
% RSD: 3.6%		Detection Criteria:	-	

RADIOTRACER

LABORATORY

Test Name: ^{14}Carbon

Lab.: Radiotracer

Units: disintegrations per minute

Period: from 03/01/81 to 31/12/81

Sample Type: Surface Waters

Sample Preparation: Samples are mixed with a scintillation "cocktail".

Analytical Procedure: Samples are analyzed by liquid scintillation counting.

Instrumentation: Two Beckman liquid scintillation counters. Models LS 233 and LS 7500.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<200,000	-	-	0

Quality Control Data:

Instrument	Number of data	Theoretical * Concentration cpm	Recovery Efficiency %	Std. Dev. of Recovery %
LS 233	45	99871	92.8	0.41
LS 7500	45	99871	94.4	0.37

Warning Limits: 0.8% Control Limits: 1.2%

* as of January 2, 1981.

Recovery Data:

Instrument	Number of data	Measured Count cpm	Std. Dev. cpm	ESCR ** (H#)	Std. Dev. ESCR (H#)
LS 233	42	78,647	1788	0.161	0.025
LS 7500	43	83,893	467	(168.4)	(2.66)

Instrument	Warning Limits	Control Limits
LS 233 Count	3576	5364
ESCR	0.05	0.08
LS 7500 Count	934	1401
H#	5.3	8.0

** ESCR (= external standard channels ratio) and H# are quench parameters for the model LS233 and LS7500 counters respectively.

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	18	7	22	47
Std. Dev.:	132	775	764	524

DORSET

LABORATORY

Test Name: ALKALINITY T.I.P.

Lab.: Dorset

Units: mg/L as $CaCO_3$

Period: from 01/07/80 to 25/11/80

Sample Type: Lakes, streams, precipitation

Sample Preparation:

Analytical Procedure: Samples (100 mL) are manually pipetted and titrated with 0.020N sulphuric acid to a pH endpoint of 3.75 with a computer controlled titration system. The titration data is then subjected to a Gran analysis.

Instrumentation: HP9810A, Radiometer PHM 64 pH meter with a combination electrode; ABU-13 Autoburette; in house interface and program.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
<25	-	0.1	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A					
B					
Long Term Blank:					
A+B					
A-B					
A+B: calc. WL		CL	actual WL	CL	
A-B: calc. WL		CL	actual WL	CL	
Std. Dev.: within, S_w=		between, S =		S/S_w =	

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					
R_1+R_2 calc. WL		CL	actual WL	CL	
R_1-R_2 calc. WL		CL	actual WL	CL	
Std. Dev.: within, S_w=		between, S =		S/S_w =	

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	103	5	1	109
Std. Dev.:	0.0557	0.0307	-	0.0546
Mean:				
% RSD: -				

Detection Criteria: 0.09

Test Name: AMMONIA - LOW RANGE

Lab.: Dorset

Units: mg/L as N

Period: from 10/01/80 to 20/10/80

Sample Type: Lakes, streams

Sample Preparation: Samples are manually filtered in the laboratory using Reeve Angel 934-AH glass fibre filters.

Analytical Procedure: Ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst. A reference stream which differs from the sample stream by replacement of the catalyst by an equal flow of distilled water is employed to blank out the effects of sample colour.

Instrumentation: Basic AA-II AutoAnalyzer system plus heating bath module (7.7 mL delay coil at 38 °C); flow cells = 50 mm; 630 nm; Std Cal (Std. dev) - 4.2 (1.33); 10x scale expansion.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.003 - 0.100	0 - 0.06 Abs.*	0.001	2

* Including scale expansion at the recorder.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	47	0.0740	0.0741	+0.001	0.00547
D	47	0.0270	0.0270	0.000	0.00399
Long Term Blank:	-	-	-	-	-
C+D	42	0.1010	0.1043	0.0033	0.00809
C-D	42	0.0470	0.0498	0.0028	0.00543

C+D: calc. WL 0.010 CL 0.016 actual WL 0.002 CL 0.003

C-D: calc. WL 0.010 CL 0.016 actual WL 0.002 CL 0.003

Std. Dev.: within, S_w = 0.00382 between, S = 0.00479 S/S_w = 1.25

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	66	17	8	91
Std. Dev.:	0.0016	0.0018	0.0061	0.0034
Mean:				
% RSD:				

Detection Criteria: 0.0026

Test Name: AMMONIA - HIGH RANGE

Lab.: Dorset

Units: mg/L as N

Period: from 10/01/80 to 20/10/80

Sample Type: Lakes, streams

Sample Preparation: As per low range.

Analytical Procedure: As per low range.

Instrumentation: As per low range.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.1 to 1.00	0 - 0.57 Abs.*	0.01	2

* Including scale reduction at the recorder (with respect to a Technicon recorder).

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	46	0.632	0.6320	0.000	0.02286
B	46	0.316	0.3164	+0.0004	0.01189
Long Term Blank:	-	-	-	-	-
A+B	40	0.948	0.960	0.012	0.03258
A-B	40	0.316	0.323	0.007	0.01881

A+B: calc. WL 0.038 CL 0.056 actual WL 0.020 CL 0.030

A-B: calc. WL 0.038 CL 0.056 actual WL 0.020 CL 0.030

Std. Dev.: within, S_w = 0.01287 between, S = 0.01798 S/S_w = 1.39

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	-	-	-	-
Std. Dev.:	0.0037	0.0155	0.0104	0.0128
Mean:	-	-	-	-

% RSD: 1.39% Detection Criteria: -

Test Name: CONDUCTIVITY

Lab.: Dorset

Units: μ S/cm

Period: from 01/07/80 to 31/12/80

Sample Type: Lakes and streams

Sample Preparation:

Analytical Procedure: The sample aliquot is introduced into a jacketed conductivity cell and equilibrated to 25° C.

Instrumentation: Radiometer CDM 3 Conductivity Meter with a 324 jacketed conductivity cell. Manual reading and recording.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
< 500	500	5	0
< 150	150	2	0

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	100	282.6	288.8	6.2	2.9542
B	100	73.9	75.77	1.87	1.3333
Long Term Blank:	100		0.445		0.0900
A+B	100	356.5	364.76	8.26	4.0480
A-B	100	208.7	214.32	5.62	3.5598
A+B: calc. WL	7.12	CL 10.7	actual WL	CL	
A-B: calc. WL	7.12	CL 10.7	actual WL	CL	

Std. Dev.: within, S_w = 2.5172 between, S = 2.2918 S/S_w = 0.91

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					
R_1+R_2 calc. WL		CL	actual WL	CL	
R_1-R_2 calc. WL		CL	actual WL	CL	

Std. Dev.: within, S_w = between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:				
Std. Dev.:				
Mean:				
% RSD:				

Detection Criteria:

Test Name: NITRATE PLUS NITRITE

Units: mg/L as N

Lab.: Dorset

Period: from 10/01/80 to 5/09/80

Sample Type: Lakes, streams

Sample Preparation:

Analytical Procedure: Via an AA-I system, nitrate is reduced to nitrite by hydrazine sulphate using copper as a catalyst. Nitrate plus nitrite are then determned by formation of an azo dye using sulphanilamide and N(1-naphthyl) ethylene diamine dihydrochloride. To control metal ion interferences, samples are passed through an Amberlite IR-120(H) ion exchange column prior to the reduction step.

Instrumentation: Basic AA-I AutoAnalyzer system plus a heating bath (7.7 mL delay coil at 38°C); 50 mm flow cell; 520 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.003 - 0.5		0.005	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	33	0.375	0.374	-0.001	0.00556
B	33	0.185	0.184	-0.001	0.00532
Long Term Blank:					
A+B	33	0.560	0.5608	0.0008	0.00991
A-B	33	0.190	0.1896	-0.0004	0.00783

A+B: calc. WL 0.016 CL 0.023 actual WL 0.010 CL 0.015

A-B: calc. WL 0.016 CL 0.023 actual WL 0.010 CL 0.015

Std. Dev.: within, S_w = 0.00511 between, S = 0.00544 S/S_w = 1.06

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1					
R_2					
Digested Blanks:					
R_1+R_2					
R_1-R_2					

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	58	24	19	101
Std. Dev.:	0.0018	0.0056	0.0123	0.0071
Mean:	-	-	-	-

% RSD: 3.2%

Detection Criteria: 0.0029

Test Name: FILTERED TOTAL PHOSPHORUS - LOW RANGE **Lab.:** Dorset

Units: µg/L as P **Period:** from 10/04/80 to 6/09/80

Sample Type: Lakes, streams

Sample Preparation: Samples must be collected in Pyrex culture tubes with Teflon liners. Samples are field filtered using Sartorius CA 0.45 µ membrane filters (no spacers).

Analytical Procedure: Samples are autoclaved in their culture tubes for 60 minutes in a sulphuric acid-potassium persulphate media at 121°C. The tubes are then presented to the AutoAnalyzer system. Orthophosphate in the digestate is determined by formation of a reduced phospho-antimonyl-molybdate complex. Ascorbic acid is the reducing agent.

Instrumentation: Autoclave plus a basic AA-II AutoAnalyzer system; scale expansion = 12x with respect to a Technicon recorder; flow cell = 50 mm; 880 nm; special phototubes; linear recorder Std cal (Std dev) = 4.28 (0.28).

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.3 to 20.0	0 - 0.03* Abs.	0.2	2

* Including expansion at the recorder.

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
C	86	17.8	17.69	-0.11	0.15806
D	86	5.8	5.90	0.10	0.10919
Long Term Blank:	86	-	0.029	-	0.161
C+D	86	23.6	23.58	-0.02	0.22912
C-D	86	12.0	11.79	-0.21	0.14094
C+D: calc. WL	0.27	CL 0.40	actual WL 0.40	CL 0.60	
A-B: calc. WL	0.27	CL 0.40	actual WL 0.40	CL 0.60	

Std. Dev.: within, S_w = 0.09614 between, S = 0.18584 S/S_w = 1.93

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_3	169	14.0	13.96	-0.04	0.69768
R_4	159	7.0	6.93	-0.07	1.0465
Digested Blanks:	261	-	1.64	0	0.7110
R_3+R_4	77	21.0	20.69	-0.31	0.83732
R_3-R_4	77	7.0	6.89	-0.11	0.71720
R_1+R_2 calc. WL		CL	actual WL	CL	
R_1-R_2 calc. WL		CL	actual WL	CL	

Std. Dev.: within, S_w= between, S = S/S_w =

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	49	152	78	279
Std. Dev.:	0.1935	0.3286	0.4116	0.3281
Mean:				
% RSD:				

Detection Criteria: 0.32

Test Name: FILTERED TOTAL PHOSPHORUS - HIGH RANGE **Lab.:** Dorset

Units: µ g/L as P **Period:** from 10/04/80 to 6/09/80

Sample Type: Streams, lakes

Sample Preparation: As per low range.

Analytical Procedure: As per low range.

Instrumentation: As per low range but with a 1.2x expansion at the recorder.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
20.0 to 200	0 - 0.31 Abs.	2	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	86	170.0	170.09	0.09	0.92835
B	86	58.0	58.54	0.54	0.68009
Long Term Blank:	-	-	-	-	-
A+B	86	228.0	228.6	0.6	1.3626
A-B	86	112.0	111.5	-0.5	0.8608

A+B: calc. WL 1.7 CL 2.6 actual WL 0.40 CL 0.60

A-B: calc. WL 1.7 CL 2.6 actual WL 0.40 CL 0.60

Std. Dev.: within, S_w = 0.61984 between, S = 0.81874 S/S_w = 1.32

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	173	140	138.82	-1.18	2.5059
R_2	174	70	70.19	0.19	1.6355
Digested Blanks:	261	-	1.644	0	0.7110
R_1+R_2	84	210	208.71	-1.29	2.8095
R_1-R_2	84	70	68.49	-1.51	1.9969

R_1+R_2 calc. WL CL actual WL CL

R_1-R_2 calc. WL CL actual WL CL

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:

	0-20%	20-50%	50-100%	Overall
Number:	53	18	2	73
Std. Dev.:	0.6857	0.9255	-	0.7485
Mean:	-	-	-	-
% RSD: -				

Detection Criteria: -

Test Name: TOTAL KJELDAHL NITROGEN

Units: mg/L as N

Lab.: Dorset

Period: from 11/09/80 to 13/11/80

Sample Type: Lakes, streams

Sample Preparation:

Analytical Procedure: Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using two block digesters kept at 200°C and 360°C. The digestate is pH adjusted in line and the ammonia content is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Instrumentation: Basic AA-II AutoAnalyzer system plus two Technicon DB 40 block digesters plus a heating bath module (7.7 mL delay coil at 38°C); 50 mm flow cell; 630 nm.

Calibration:

Conc. Range	Operating Scale	Resolution	#Stds.
0.02 to 1.00	-	0.01	2

Quality Control Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
A	14	0.750	0.7488	-0.0012	0.003625
B	14	0.250	0.2485	-0.0015	0.003755
Long Term Blank:	14	-	0.0054	-	0.006640
A+B	14	1.000	0.9971	-0.0029	0.008018
A-B	14	0.500	0.4993	-0.0007	0.004322
A+B: calc. WL	0.008	CL 0.012	actual WL		CL
A-B: calc. WL	0.008	CL 0.012	actual WL		CL

Std. Dev.: within, S_w = 0.00226 between, S = 0.00369 S/S_w = 1.63

Recovery Data:

	Number of datums	Theoretical Concentration	Concentration Found	Ave. Bias	Std. Dev.
R_1	17	0.700	0.6962	-0.0038	0.02281
R_2	17	0.280	0.2882	0.0082	0.01145
Digested Blanks:	50	-	0.017	-	0.0115
R_1+R_2	17	0.980	0.9844	0.0044	0.0286
R_1-R_2	17	0.420	0.4079	-0.0121	0.0221
R_1+R_2 calc. WL		CL	actual WL		CL
R_1-R_2 calc. WL		CL	actual WL		CL

Std. Dev.: within, S_w = - between, S = - S/S_w = -

Duplicate Data:	0-20%	20-50%	50-100%	Overall
Number:	45	156	27	228
Std. Dev.:	0.0139	0.0200	0.0229	0.0196
Mean:				
% RSD: 3.05%				

Detection Criteria: 0.022

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387
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